

Assessment of interlabial space, maxillary tooth display, gingival display in a static and dynamic smile: A pilot study

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ABSTRACT

Background: A dynamic smile is instinctive and communicates the emotion being felt at the time, and a static smile, which is a controlled smile used in social contexts or when being photographed. It seems inappropriate to judge a smile, which is a dynamic action, just from still images. Objective of this study was to assess smiles using photographic and videographic techniques in both static and dynamic forms.

Materials and Methods: 15 voluntary participants, ages 18 to 30, a frontal smile photo and a smile video clip were taken using a Canon EOS 1500D camera. Digital files were assessed using the Adobe Photoshop CS2 software, and parameters were measured.

Result: Inter-labial gap [12.25 vs 10.0] and gingival display [0.0 vs 1.0] were considerably higher at dynamic smile than static smile. The parameters of a static and dynamic smile, which were measured on the first day and the tenth day, had an almost complete intra-rater agreement in both cases.

Conclusion: This study found a significant difference between static and dynamic smiles, with dynamic smiles having higher values for inter-labial gap, maxillary tooth display and gingival show. Both had reliable consistency and reproducibility.

Keywords: Interlabial space, Static, Dynamic, Smile, Esthetics.

INTRODUCTION

Characteristics of a smile are determined by the interaction of static and dynamic links between the dentoskeletal and soft tissue components of the face. According to Ackerman et al., stage I is a posed smile, while stage II is an unposed smile^{1,2,3,4}. In contrast to a spontaneous smile, which is instinctual and expresses the emotion being felt at the time, a posed or static social smile is a controlled smile used in social events or when being photographed. The use of videography to assess smiles was

pioneered by Ackerman and Ackerman¹, Sarver and Ackerman⁵, and Sarver and Ackerman⁶. It seems inappropriate to judge a smile, which is a dynamic action, just from still images. During treatment evaluation, prognosis, planning, progress, outcomes, and retention as a marker of total face and smile aesthetics. Despite the fact that many studies have focused on the posed smile with all of the facial characteristics. Dynamic smile is rarely used as a regular orthodontic record, although being

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recommended to be taken as such by Ackerman¹ in 1998. For smile-related research, it is necessary to characterize and take into account both posed and spontaneous smiles. The bulk of studies on smile analysis use posed smiles as their data. Surprisingly, we were unable to locate any published research on the consistency and repeatability of both static and dynamic smiles despite a thorough web search. Because of this, the purpose of this study was to

Aim: To assess the inter-labial space, maxillary tooth display, gingival display in static and dynamic smile.

Objectives:

1. To compare the inter-labial gap, maxillary tooth display, gingival display at smile in both dynamic and static smile.
2. To assess the consistency and reliability of static smile and dynamic smile by analyzing smile parameters.

Study Design: Longitudinal, Observational & Comparative study.

Null Hypothesis: There is no significant difference in the smile parameters in both dynamic and static smile.

Alternate Hypothesis: There is significant difference in the smile parameters in both dynamic and static smile.

Inclusion Criteria-

1. Subject's age in between 18 to 30 years.
2. No history of previous orthodontics treatment, facial surgery and trauma.
3. Absence of - syndromic, severe antero-posterior, transverse & /or vertical dysplasia, neuromuscular disorders, cleft lip and cleft palate, gross skeletal asymmetry.

Exclusion Criteria- Subjects having following condition will be excluded from study.

1. Prosthetic or restorative work on tooth/teeth visible on smiling.
2. Gingival recession on teeth visible on smiling.

compare smiles using both photographic and videographic methods. By consistently identifying the various aspects of a smile that need to be corrected, improved, or enhanced, as well as determining whether the attribute contributes positively or negatively to the design of a subject's smile, the results of this study will help orthodontists make a more accurate diagnosis.

3. Excessive attrition on tooth/teeth visible on smiling.
4. Subject having missing tooth/teeth that could be seen on smiling.
5. Presence of caries on anterior tooth/teeth visible on smiling.

MATERIALS AND METHOD

When the institutional ethical committee gave the study approval and each participant gave their informed permission, a random sample of students, employees, residents, and patients who reported to the emergency rooms of several institutes affiliated with Malwanchal University in Indore was chosen as participants. A Canon DSLR-1500D camera with full HD recording in 24, 25, and 30 fps, ISO 100-6400, was mounted on a tripod to take frontal pictures and record video at a distance of 4 feet from the subject. To avoid casting shadows on the subject in the video, a portrait light was kept behind the camera. In order to avoid mistakes in head positioning, the participants were asked to hold their heads in a natural posture by gazing directly into an imaginary mirror. If necessary, the photographer was to assist the subject in holding their heads in the proper position, and the camera lens needed to be adjusted to be level with the occlusal plane. Asking the participant to lick their lips and then swallow produced the slack lip position. At that time, the students were being taught to say, "Subject number, my title is cheese," followed by a smile. One second before the subject started speaking, the recording began, and it ended when the person smiled. After swallowing, the frontal smile photo is taken at a posed smile. After being imported into Adobe Premiere Pro software, the recorded video clips were exported as 30 fps photo frames to laptop storage. Then, from among all the frames, the one with the best smile was chosen.

Table 1. Comparison of inter-labial gap, maxillary anterior tooth display, gingival display at smile in both dynamic and static smile.

Comparison of inter-labial gap at smile in both dynamic and static smile.				
	Median	Inter-quartile range	Z value	p value ^a
Static smile	10.0	9.25-12.0	-3.953	.001*
Dynamic smile	12.25	11.25-14.75		
Comparison of maxillary anterior tooth display at smile in both dynamic and static smile.				
	Median	Inter-quartile range	Z value	p value ^a
Static smile	10.0	8-10.5	-3.450	.001*
Dynamic smile	10.0	9.0-11.0		
Comparison of gingival display at smile in both dynamic and static smile				
	Median	Inter-quartile range	Z value	p value ^a
Static smile	0.0	0.0-1.0	-2.961	.003*
Dynamic smile	1.0	0.5-2.5		

Table 2. Status of Study population with same result with respect to different parameters (Qualitative assessment-after applying Chi-square test)

ILG		
	Same Result N (%)	Different Result (%)
Static Smile	0 (0%)	20 (100%)
Dynamic Smile	14 (70%)	06 (30%)
Chi-Square Value- 21.53, df-1, p value- 0.000 (Very Highly Significant)		
MATD		
	Same Result N (%)	Different Result (%)
Static Smile	5 (25%)	15 (75%)
Dynamic Smile	14 (70%)	06 (30%)
Chi-Square Value- 8.12, df-1, p value- 0.0043 (Significant)		
GD		
	Same Result N (%)	Different Result (%)
Static Smile	11 (55%)	09 (45%)
Dynamic Smile	19(95%)	01 (5%)
Chi-Square Value- 8.53, df-1, p value- 0.003 (Significant)		

Table 3. Status of Study population based on Mean difference with respect to different parameters (Quantitative assessment after applying paired 't' test)

ILG		
	Mean Difference in mm	Standard deviation in mm
Static Smile	0.95	1.5
Dynamic Smile	0.45	0.75
p value- 0.096 (Not Significant)		
MATD		
	Mean Difference in mm	Standard deviation in mm
Static Smile	0.52	1.05
Dynamic Smile	0.42	0.76
p value- 0.635 (Not Significant)		
GD		

	Mean Difference in mm	Standard deviation in mm
Static Smile	0.32	0.43
Dynamic Smile	0.05	0.22
p value- 0.03 (Significant)		

Table 4. Comparison of parameters of Static smile & Dynamic smile at two occasions (7th day and 14th day).

Comparison of parameters of static smile at two occasions (7th day and 14th day).					
Parameter	Visit	Median	Inter-quartile	Z value	P value ^Ω
Inter labial gap	1 st day	10.0	9.25-12.0	-2.440	.015*
	10 th day	12.0	10.25-14.0		
Maxillary anterior tooth display	1 st day	10.0	8.0-10.5	-1.893	.058
	10 th day	10.0	9.0-11.0		
Gingival display	1 st day	0.0	0.0-1.0	-2.754	.006*
	10 th day	0.75	0.0-1.875		
Comparison of parameters of dynamic smile at two occasions (7th day and 14th day)					
Parameter	Visit	Median	Inter-quartile	Z value	P value
Inter labial gap	1 st day	12.25	11.25-14.75	-2.251	.024*
	10 th day	13.0	12.0-14.75		
Maxillary anterior tooth display	1 st day	10.0	9.0-0.5	-2.207	.027*
	10 th day	11.0	10.0-11.0		
Gingival display	1 st day	1.0	0.5-2.5	-1.000	.317
	10 th day	1.5	0.5-2.5		

Table 5. Intra-rater reliability assessment of parameters of static smile & Dynamic smile.

Intra-rater reliability assessment of parameters of static smile		
Parameter	Intra-class correlation coefficient	P value
Inter labial gap	.878	.001*
Maxillary anterior tooth display	.868	.001*
Gingival display	.940	.001*
Intra-rater reliability assessment of parameters of dynamic smile.		
Parameter	Intra-class correlation coefficient	P value
Inter labial gap	.965	.001*
Maxillary anterior tooth display	.904	.001*
Gingival display	.991	.001*

Measured and compared were the selected smile frame image and the frontal posed smile image loaded into Adobe Photoshop CS2. Similar to this, the patient had their frontal smile recorded on video and photographed between the hours of 11 a.m. and 1 p.m. on the first and tenth days. The measurements were measured both at static and dynamic smile and then compared in mm such are Inter-labial gap (A), Maxillary anterior tooth display (MATD) (B), Gingival display (GD) (C), as schematic representation given in figure 1.

Statistical Analysis: Data was entered into the excel sheet. Data was analyzed using SPSS (Statistical Package for Social Sciences) 21.0 version. Data was analyzed for probability distribution using Kolmogorov-Smirnov test, p value <.05 indicated that the data were not normally distributed. Descriptive statistics was performed and data were described as median and inter-quartile range. Comparison of study parameters at static and dynamic smile was done using Wilcoxon sign rank test. p value <.05 was considered statistically significant.

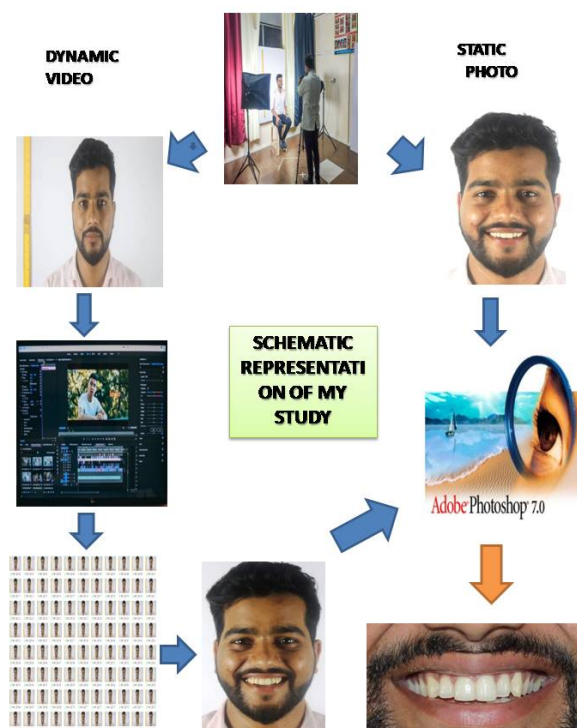


Fig 1: Schematic representation of method

RESULTS

The study included 15 participants.

Comparison of inter-labial gap, maxillary anterior tooth display, and gingival display at smile in both dynamic and static smile showed that. (Table 1)

- The inter-labial gap was significantly more at dynamic smile as compared to static smile [12.25 (11.25-14.75) vs 10.0 (9.25-12.0)] (p value <.05).
- The maxillary anterior tooth display was significantly more at dynamic smile as compared to static smile [10.0 (9.0-11.0) vs 10.0 (8-10.5)] (p value <.05).
- The gingival display was significantly more at dynamic smile as compared to static smile [1.0 (0.5-2.5) vs 0.0 (0.0-1.0)] (p value <.05).

In Qualitative assessment-after applying Chi-square test (Table 2) & Quantitative assessment after applying paired 't' test (Table 3) -

Comparison of parameters of Static smile at two occasions showed that,

- The values of inter-labial gap and gingival display as recorded by observer on 10th day was significantly more as compared to that recorded on 1st day (p value <.05).
- The values of maxillary anterior tooth display as recorded by observer on 1st day and 10th day was statistically non-significant (p value >.05).

Comparison of parameters of Dynamic smile at two occasions showed that,

- The values of inter-labial gap and maxillary anterior tooth display as recorded by observer on 10th day was significantly more as compared to that recorded on 1st day (p value <.05).

The values of gingival display as recorded by observer on 1st and 10th day was not found to differ significantly (p value >.05).

Comparison of parameters of Static smile & Dynamic smile at two occasions (7th day and 14th day) showed that, (Table 4)

Static smile: The values of inter-labial gap as recorded by observer on 10th day was significantly more as compared to that recorded on 1st day (p value <.05). The values of maxillary anterior tooth display as recorded by observer on 1th day and 10th day was statistically non-significant (p value >.05). The values of gingival display as recorded by observer on 10th day was significantly more as compared to that recorded on 1st day (p value <.05).

Dynamic smile: The values of inter-labial gap as recorded by observer on 10th day was significantly more as compared to that recorded on 1st day (p value <.05). The values of maxillary anterior tooth display as recorded by observer on 10th day was significantly more as compared to that recorded on 1st day (p value <.05). The values of gingival display as recorded by observer on 1st and 10th day was not found to differ significantly (p value >.05).

In intra-rater reliability assessment of parameters of static smile & Dynamic smile, we found, (Table5)

- Static smile: There was almost perfect agreement intra-rater agreement between the parameters of static smile as assessed on 1st day and 10th day. The correlation between two sets of observation was statistically significant (p value <.05).
- Dynamic smile: There was almost perfect agreement intra-rater agreement between the parameters of dynamic smile as assessed on 1st day and 10th day. The correlation between two sets of observation was statistically significant (p value <.05).

DISCUSSION

The majority of nations consider a smile to be a polite greeting. In social circumstances like job interviews and interactions, as well as while trying to find a mate, having a beautiful smile is commonly seen as an advantage today's society. These days, our culture values smiling highly and increasingly emphasizes aesthetics. However, a review of the dental and orthodontic literature reveals that while there is a lot of supposition around "smile design" and cosmetic smile treatments, there are actually very few solid scientific studies available Recent scientific research have introduced a fresh method of capturing and evaluating the smile utilizing videography and computer software, in contrast to past studies that used static photographs to analyses smile aesthetics.⁷

Ackerman et al, Ackerman and Ackerman, and Sarver and Ackerman deserve credit for using videography to analyze smiles.^{1,5,6,8} With the use of computer software to analyze and measure smiles, we are able to extract the frame that best represents patients' social smiles and the measurement errors can be greatly reduced. We can achieve a much more predictable and standardized smile using a video (about 30 frames per second) than by static photographs. The construction of an aesthetically pleasing smile can be aided by analyzing the smile and establishing averages for each of its distinct components.^{5,6,7,8}

In my study, 15 people in the 18–30 age range without obvious facial asymmetry had their

dynamic and posed smiles' three separate parameters analyzed and compared. The focus was focused on the consistency and reproducibility of both the static and dynamic smiles. Using a Canon EOS 1500D camera and a 24.1-megapixel Canon macro lens (18-55mm), a frontal smile photo and a smile video clip were made for each person. Using the Adobe Photoshop CS2 programmed, digital assets were evaluated before being measured and compared. Similar to this, the patient had their frontal smile recorded on video and photographed between the hours of 11 a.m. and 1 p.m. on the first and tenth days.

The following measurements were measured both at static and dynamic smile and then compared (in mm).

- **Inter-labial gap (ILG)** - Comparison of inter-labial gap at smile in both dynamic and static smile showed, the inter-labial gap was significantly more at dynamic smile as compared to static smile. (Table 1)
- **Maxillary anterior tooth display (MATD)** - Comparison of maxillary anterior tooth display at smile in both dynamic and static smile showed, the maxillary anterior tooth display was significantly more at dynamic smile as compared to static smile. (Table 1)
- **Gingival display (GD)** - Comparison of gingival display at smile in both dynamic and static smile showed the gingival display was significantly more at dynamic smile as compared to static smile. (Table 1)

In my study, 15 people in the 18–30 age range without obvious facial asymmetry had their dynamic and posed smiles' three separate parameters analyzed and compared. The focus was focused on the consistency and reproducibility of both the static and dynamic smiles.

Using only static photographs to evaluate a smile, which is a dynamic activity, seems improper. As a measure of the overall aesthetics of the face and smile during treatment, evaluation, prognosis, planning, progress, outcomes, and retention. Even though numerous studies have concentrated on the posed smile with all of the facial features. Even though Ackerman¹ advised taking Dynamic Smile as a regular orthodontic record in 1998, it is rarely

used in this capacity. Consequently, I conducted a study on the consistency and dependability of both static smiles.

In both, there was an almost perfect intra-rater agreement between the parameters of static smile and dynamic smile as assessed on the first day and the tenth day. This was demonstrated by the intra-rater reliability assessment of these parameters. A statistically significant correlation existed between the two sets of observations (p value.05).(Table 5)

CONCLUSION

There was a substantial difference between the static and dynamic smiles in this study, with the dynamic smile having significantly higher values for factors including the inter-labial gap, the exhibition of the maxillary front teeth, and the gingival display. Both the static smile and the dynamic smile were found to be consistent and repeatable in the intra-rater reliability assessment of parameters for the static smile and dynamic smile on the first day and the tenth day.

However, a Comparison of parameters of static smile and dynamic smile on two occasions concluded that,

- i. The gingival display was more consistent in the case of a dynamic smile.
- ii. Maxillary anterior tooth display was more consistent in the case of a static smile.

As a result, both a static and a dynamic smile can be used as indicators of overall facial and smile aesthetics in treatment evaluation, prognosis, treatment planning, progress, results, and retention. These indicators also aid orthodontists in precisely diagnosing patients' smiling issues and choosing the best course of action. To validate the results from

this study for use in future research, a randomized clinical trial with a bigger sample size and a diverse population is required.

REFERENCES

1. Ackerman JL, Ackerman MB, Brensinger CM, Landis JR. A morphometric analysis of the posed smile. *Clin Orthod Res*. 1998; 1:2-11.
2. Krishnan V, Daniel S T, Lazar D, Asok A. Characterization of posed smile by using visual analog scale, smile arc, buccal corridor measures and Modified smile index. *Am J Orthod Dentofacial Orthop*. 2008; 133:515-23.
3. McNamara L, McNamara JA, Ackerman MB, Baccetti T. Hard and soft tissue contributions to the esthetics of the posed smile in growing patients seeking orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 2008; 133:491-9.
4. Havens DC, McNamara JA, Sigler LM, Baccetti T. The role of the posed smile in overall facial esthetics. *Angle orthod*. 2010; 80:322-328.
5. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 1. Evolution of the concept and dynamic records for smile capture. *Am J Orthod Dentofacial Orthop*. 2003; 124:4-12.
6. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 2. Smile analysis and treatment strategies. *Am J Orthod Dentofacial Orthop*. 2003; 124:116-27.
7. C Maulik, R Nanda. Dynamic smile analysis in young adults. *AmJ Orthod Dentofacial Orthop*. 2007; 132:3:307-15.
8. Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. *J. Clin. Orthod*. 2002; 36:221-36.