



DIGITAL VIDEOGRAPHY AND SMILE LINE ASSESSMENT IN NORMAL ADULTS AND ADULTS WITH MAXILLARY CONSTRICTION.

Dental Science

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ABSTRACT

OBJECTIVE: This study compares the frontal smile characteristics between normal adults and adults with maxillary constriction using digital videography. **MATERIALS AND METHODS:** The sample of this study consisted of 60 subjects aged between 16-25 years. The subjects were divided into 2 groups based on maxillary constriction with 30 subjects in each group. The 2 groups were control group and study group. According to Korkhaus analysis done on patient's casts, subjects were divided into 2 groups based on maxillary constriction. Digital videographic recordings were obtained using standardized protocol in NHP. **CONCLUSION:** In our study, we found that there were no statistically significant differences observed in frontal smile characteristics obtained between control group and study group. A statistically significant difference was observed in smile arc between two groups.

KEYWORDS

INTRODUCTION:

The word 'Digitalization' have been popularized over a period of decade and half. Recent innovations in digital world have been used in studies to improve and for accuracy in diagnosis and treatment planning. 1 previously static photographs were used to determine smile and aesthetics, 2 which lacks dynamic expression or spontaneous expression. In this study we used digital videography for recording spontaneous smile or dynamic expression of the face. In day -day practice there is increasing awareness for orthodontic treatment. Among the goals of Jackson's triad, esthetic harmony is a primary importance. The more use of social media, people were aware of different orthodontic esthetic materials. The people particularly in glamour field are more focused on esthetics and smile. The frontal smile characteristics include buccal corridor space, smile arc, smile index and modified smile index. Among, buccal corridor space and the smile arc are the components of balanced smile. Buccal corridor space is the one of the important feature in transverse dimension.³

One of the most common transverse problems is that of maxillary constriction. Individuals with maxillary arch constriction display unesthetic smile, as arch form plays a vital role in transverse dimension. The studies carried out so far have not evaluated the effect of maxillary constriction on smile esthetics. Therefore, this study compares Smile esthetics between normal adults and adults with maxillary constriction using digital videography.

MATERIALS AND METHODS:

Hundred subjects with an age range between 18-25 years were selected randomly from students, residents, staff and patients in the campus of C K S Teja educational institution based on the following criteria.

INCLUSION CRITERIA

1. Patients with complete permanent dentition except 3rd molars and with no missing or supernumerary teeth.
2. Patients with no excessive attrition.
3. Patients with no severe malocclusions
4. Patients with no periodontal diseases.

EXCLUSION CRITERIA

1. Patients with gross asymmetries.

2. Patients with prosthodontic or restorative work on the teeth visible on smiling.
3. Patients with lip irregularities/ with history of lip surgery / lip scars / with history of lip enhancements
4. Patients with previous history of orthodontics/ orthopedic/ orthognathic surgical treatment.
5. Patients with sagittal and vertical discrepancies of maxilla.
6. Patients with canted occlusal plane as revealed by clinical examination and those with gross asymmetrical maxillary dental arches.

After preliminary clinical examination, both upper and lower impressions were made. Korkhaus analysis was performed to determine the presence or absence of maxillary constriction. Finally, subjects were categorized into two groups. The individuals with maxillary constriction according to Korkhaus analysis which comprised experimental group and those with normal maxilla includes control group.

After examination, seventy subjects were fulfilled the inclusion criteria, forty subjects shared normal arch and thirty were with constricted maxilla. So in order to maintain equal proportion, a sample size of thirty was included in control group and thirty with experimental group.

Before recording the smile, natural head position was established using a modified method approach for obtaining cephalograms as suggested by N Sleeva Raju et.al. 4 A mirror 4x2 feet in size is fixed on the wall about 3 feet from floor level. To obtain a true vertical, a plumb line is created by suspending a weight of 4 kg on a 0.016-inch wire hung from ceiling, 9 feet in front of the mirror. The subject stands to the left of the plumb line looking into the mirror. A kavo light source (12V) I fixed 7 foot 6 inches to the right wall, at a height of 5 foot 3 inches. The light rod can move only in a vertical direction to adjust the level of the light source depending on the subject's head height. The light casts a shadow of the wire on the right side of the patient's face; just distal to the lateral canthus of the eye. The light does not have any horizontal movement thus preventing a shift of the wire shadow in a horizontal direction since this could alter the true vertical reference. The subject's foot marks are marked on the floor so that the individual can be

repositioned in the same place to check the precision of the method. The subject is then asked to determine the self-balanced position of the head by tilting the backward and forward with decreasing amplitude to find the most neutral position. After determining the self-balanced position, the subject is asked to look into his/her own eyes in the mirror (Fig 1). At this juncture, two points are marked using a pen along the wire shadow on the right side of the subject's face, one near the lateral canthus of the eye and the other at the lower border of the mandible. These areas are selected for placing the markers since no important landmarks were located here. Most often, it is not possible to mark both the points simultaneously along the shadow of the wire because of the head movement during breathing. Hence, the upper point is marked first, and when the wire shadow comes in line with the upper point, the lower point is marked. Then, the entire procedure is repeated to check the precision of the method by seeing whether the two points again fall on the shadow of the wire. When it is confirmed that the subject repeatedly gives the same NHP, tiny circular metal markers are fixed on each point by using a cellophane tape. The markers will give radiopaque shadows on the lateral cephalogram. Thus the natural vertical axis is fixed on the face.



Figure.1: Set up for natural head position

Video Recording: After obtaining Natural head position of each participant, video recording was made with a spontaneous smile of joy and a posed social smile. The video recordings were made in a set up consisting of a chair with a digital video camera (Sony handy cam DCR_DVD 710E). The camera is kept on a tripod which is three feet away from the subject. To provide a supplemental light, two spot lights were used. A customized wooden stand was placed at the patient's chin level to provide a scale in the image. When the visual axis was horizontal, the subjects kept their heads mainly in a natural head position. The video recording was done for an about 3-5 minutes by playing jokes to the patient, until natural spontaneous smile was obtained. (Fig no.2)

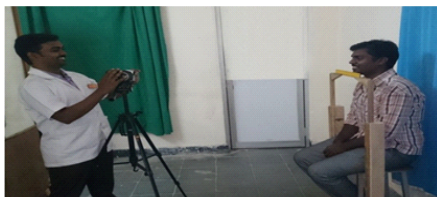


Figure.2: Digital video recording of smile

Analysis of Video clips: The subject's digital video streams were imported to the video editing software VLC player. The raw digital video stream for each subject was edited to select a snap shot representing the subject's spontaneous smile for evaluation. (Fig 3, 4)

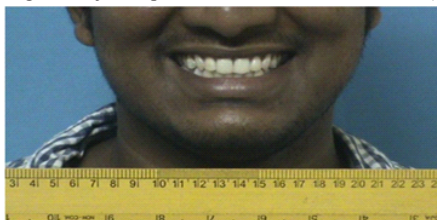


Figure 3: Normal adult male snap

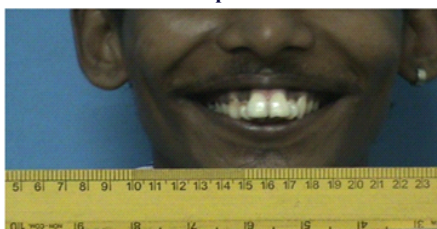


Figure 4: Constricted adult male snap

Evaluation of Smile with Software: The study parameters were evaluated on software developed by Planck Technical, Hyderabad. The software is developed in Matlab R2013a version through which our variables obtained. The developed software contains a scale to calibrate to fulfill the standardization, procedure for loading an image, zoom-in, zoom-out options, to scroll the image to desired position. It also provides vertical and horizontal guides for measuring the various parameters. Then buccal corridor space, smile index, modified smile index, smile line, smile arc were calculated for each sample. (Fig 5, 6)

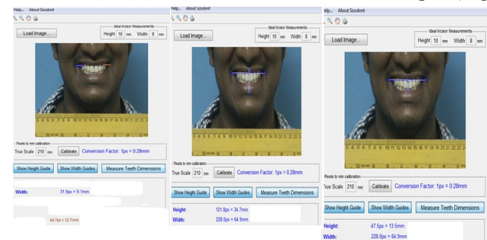


Figure.5: Calculated normal adult snap shots

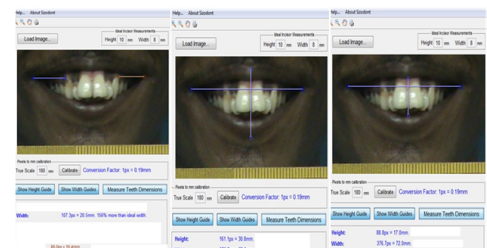


Figure 6: calculated constricted adult snap shots

RESULTS:

The statistical methods employed for the study were

- Paired 't' test
- Chisquare test
- ANOVA

The means, standard deviations, t-value and p value of all smile parameters in two groups were measured for smile line assessment.

1. Comparison of smile characteristics in study and control group (Table 1):

Table 1: Difference between Study and Control Groups

	Group	N	Mean	Std. Deviation	t-value	p value	sig
BUCCAL CORRIDOR SPACE Left	Study Group	30	13.660	2.292	0.940	0.351	NS
	Control Group	30	13.093	2.375			
BUCCAL CORRIDOR SPACE Right	Study Group	30	14.230	2.684	1.891	0.064	NS
	Control Group	30	12.793	3.181			
SMILE INDEX	Study Group	30	5.375	2.090	0.334	0.740	NS
	Control Group	30	5.223	1.367			
MODIFIED SMILE INDEX	Study Group	30	42.742	8.179	0.687	0.495	NS

Various smile parameters like buccal corridor space on left and right sides of subjects of groups, smile index, and modified smile index did not show statistically significant difference between two groups. No significant difference in left buccal corridor space, however with mean of 13.660, standard deviation of 2.292 in the study group. No significant difference in left buccal corridor space, however with mean of 13.093, standard deviation of 2.375 in control group, 't' value (0.940) (p value =0.351). No significant difference in right buccal corridor space, however with mean of 14.230, standard deviation of 2.684 in study group. No significant difference in right buccal corridor space, however with mean of 12.793, standard deviation of 3.181 in

	Control Group	30	44.228	8.583			
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control group, 't' value (1.891) (p value =0.064).No significant difference in smile index in the study group with mean of 5.375, standard deviation of 2.090.No significant difference in smile index in the control group with mean of 5.223, standard deviation of 1.367, 't' value (0.334)(p value=0.740).

To know the differences within the study and control group, ANOVA test was performed.

2) Comparison of smile characteristics within study group (Table 2):

Table 2: Control Group Difference

Variable	Group	N	Mean	Std. Deviation	f-value	p value	sig
BUCCAL CORRIDOR SPACE Left	Low	6	12.717	1.615	0.478	0.700	NS
	Average	16	12.975	2.700			
	High	6	14.083	1.277			
	Gummy	2	12.200	4.950			
BUCCAL CORRIDOR SPACE Right	Low	6	13.200	2.779	0.991	0.412	NS
	Average	16	12.813	3.773			
	High	6	13.533	1.491			
	Gummy	2	9.200	0.141			
SMILE INDEX	Low	6	6.793	2.197	5.871	0.003	S
	Average	16	5.096	0.684			
	High	6	4.301	0.468			
	Gummy	2	4.297	0.198			
MODIFIED SMILE INDEX	Low	6	40.553	8.070	1.379	0.271	NS
	Average	16	44.121	9.686			
	High	6	44.771	4.172			
	Gummy	2	54.482	4.777			

No significant difference observed in smile parameters of buccal corridor space, but there was a significant difference in smile index of different smile line subjects of 'f' value 7.751, (p value=0.001) and also in modified smile index with 'f' value 8.315, (p value=0.000)

3) Comparison of smile characteristics within control group (Table 3):

Table 3: Study Group Differences

Variable	Group	N	Mean	Std. Deviation	f-value	p value	Sig
BUCCAL CORRIDOR SPACE Left	Low	4	14.175	1.926	0.485	0.696	NS
	Average	13	13.131	2.542			
	High	11	13.882	2.358			
	Gummy	2	14.850	0.212			
BUCCAL CORRIDOR SPACE Right	Low	4	14.600	1.849	0.924	0.443	NS
	Average	13	13.562	3.052			
	High	11	15.155	2.580			
	Gummy	2	12.750	0.495			
SMILE INDEX	Low	4	8.492	4.077	7.751	0.001	S
	Average	13	5.502	0.943			
	High	11	4.566	0.677			
	Gummy	2	2.773	1.311			
MODIFIED SMILE INDEX	Low	4	32.767	9.415	8.315	0.000	S
	Average	13	43.523	4.783			
	High	11	42.449	5.260			
	Gummy	2	59.219	13.151			

No significant difference observed in smile parameters of buccal corridor space and modified smile index, but there was a significant difference in smile index of different smile line subjects with 'f' value 5.871, (p value=0.003).

4) Comparison of smile line difference between study and control group (Table 4):

Table 4: Smile Line Difference between Study and Control Group

Variable	Group	N/%	Study Group	Control Group	TOTAL	Chi square	p value	Sig
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Smile Line	Low	N	4	6	10	2.181	0.536	Ns
		%	6.70%	10.00%	16.70%			
	Average	N	13	16	29			
		%	21.70%	26.70%	48.30%			
	High	N	11	6	17			
		%	18.30%	10.00%	28.30%			
	Gummy	N	2	2	4			
		%	3.30%	3.30%	6.70%			
Total	N	30	30	60				
	%	50.00%	50.00%	100.00%				

No significant difference observed in smile line between study and control group among different smile line subjects by performing Chi square test, with Chi value of 2.181, (p value=0.536).

5) Comparison of Smile arc difference between study and control group (Table 5):

Table 5: Smile ARC difference between Study and Control Group

Variable	Group	N/%	Study Group	Control Group	Total	Chi square	p value	Sig
Smile ARC	Consonant	N	5	21	26	17.376	0.000	S
		%	8.30%	35.00%	43.30%			
	Non Consonant	N	25	9	34			
		%	41.70%	15.00%	56.70%			
Total	N	30	30	60				
	%	50.00%	50.00%	100.00%				

There was a significant difference observed between the two groups with Chi value of 17.356, (p value=0.000). And also there is a difference in smile arc within the group which was not significant.

DISCUSSION:

Evaluation of frontal smile characteristics using digital videography is a valuable aid to establish norms for diagnosis and treatment planning. Digital videography helps in recording normal and spontaneous smile than static photographs. The method used is, after establishing NHP, the natural smile is recorded for about 5 minutes or until desired (natural) smile is obtained by playing jokes and social interaction with the person. The most acceptable snapshot is taken for analysis by using customised software.

The frontal smile characteristics include Buccal corridor space, Smile index, Modified smile index and Smile arc (which are included in this study). There are few studies which described its real influence on frontal smile and method used to measure. According to Roden-Johnson method, BCS is distance measured between the lateral junction of the upper lips and the distal points of the canines during smiling.⁶

Smile Index is calculated by measuring intercommissure width and dividing by interlabial gap given by Ackermann and Ackermann, which is helpful for comparing smiles among different patients or across time in one patient⁷. Vinod Krishnan standardised Smile Index by including lips, this was done to mainly to make the calculated value comparable with other indices.

The smile arc is defined as the relationship of the curvature of the incisal edges of the maxillary incisors and canines to the curvature of lower lip in the posed smile. The ideal smile arc has the maxillary incisal edge curvature parallel to the curvature of the lower lip.⁸

The purpose of this study was to record spontaneous smile with digital videography which is reliable method to quantify frontal characteristics in normal and constricted adults. According to the study conducted by Roden-Johnson, there was no significant difference in smile scores related to BCS for all samples. The method used to measure the BCS is 'the distance between the lateral junction of the upper lips and the distal points of the canines during smiling. He conducted study on broader arch forms and tapered arch forms by using photographs.

Roden-Johnson et al, using computer simulations of buccal corridor spaces, validated Husley's findings using smiles with three different arch forms to display absent and large buccal corridor spaces, which were rated on a visual scale (VAS). Orthodontists preferred normal to broad arch forms compared with untreated, narrower arch forms, whereas lay people demonstrated no preference.⁷More significantly, buccal corridor spaces did not have an effect on the smile ratings of

orthodontists, general dentists, and lay people.⁹

The values obtained from our study were similar. Though was a difference in BCS left and right sides, but statistically not significant. In this study, a sample of 30 normal and 30 constricted adult's spontaneous smile is recorded. The results obtained with mean of 13.093 and 13.660 on the left side, whereas 12.793 and 14.230 on right side respectively. However this difference were not significant with 't' value (0.940) (p value =0.351) on left side and , 't' value (1.891) (p value =0.064) on right side respectively.

As the smile index denotes youthful smile, there was no significant difference in control and study group with mean of 5.223 & 5.375 respectively. Our observation from this study was that Smile index depends on balanced face. It increased in subjects who have a smaller lower one third of face. It is also influenced by lip length deficiencies and excess. But there was significant difference in the study group among different smile line subjects with 'f' value of 7.751 & p value of 0.001. This could be due to the amount of constriction in the maxilla.

A modified smile index shows no significant difference between control and study group with mean of 44.228 & 42.742 respectively. However there was a difference within the study group with 'f' value of 8.315 & p value 0.000, but there is no difference in control group although including Class I, Class II & Class III malocclusions.

Smile line observed in this study was not significant between the groups. Most of the subjects were with average smile line and lesser with gummy smile line from the both the groups. Subjects with low smile were more in control group and high smile line are more in study group. This may be due to proclined maxillary incisors which will cause incisor display to increase.

In this study, smile arc was significantly different between the groups, with Chi value of 17.356, (p value=0.000). Most of the subjects were displaying non consonant smile arc in study group and consonant smile arc in control group. However 9 subjects display non consonant smile arc even in control group which may be due to crowding, ectopic position of teeth, and some amount of proclination. In this study, 5 subjects display consonant smile arc was also observed among study group.

An ideal smile arc or a consonant smile arc with a lower lip was considered the most acceptable.

CONCLUSION:

- In our study, we found that there was no statistically difference observed in frontal smile characteristics between control and study group except for smile arc.
- The statistically significant difference observed in smile index and modified smile index of study group among different smile line subjects.
- The statistically significant difference observed in smile index of study group among different smile line subjects.

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