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Research Article

EVALUATION OF SMILE PARAMETERS IN GROWING AND NON - GROWING INDIVIDUALS - A PHOTOGRAPHIC STUDY

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A R T I C L E I N F O

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A B S T R A C T

Aims and Objectives, of Study: To evaluate the static norms for various smile parameters in growing and non growing individuals and to analyze and quantify the sexual dimorphism of smile parameters. ***Material And Method:*** The purpose of the study was to evaluate the smile parameters namely buccal corridor ratio, smile index , smile breadth in growing and non- growing individuals. Frontal smiling photographs of 200 individuals were divided into two groups, GROUP A consisted 100 growing male and female individuals, GROUP B consisted of 100 Non growing male and female individuals. Buccal corridor, smile index and smile breadth ratios were derived from these photographs. ***Results:*** Buccal corridor ratio in esthetically pleasing non –growing male was 8.5 % and in non-growing female was 10.5%. In growing male the buccal corridor ratio was 7.2 % and in growing male was 8.1%. Smile index in esthetically pleasing non-growing male was 5.790, in non-growing female was 5.833, in growing male was 4.918 and in growing male was 5.659. Smile breadth in esthetically pleasing non-growing male was 0.486 and in non -growing female was 0.493, in growing male was 0.492 and in growing male was 0.497.
Conclusion: These important esthetic parameters must be considered in determining and executing appropriate individual treatment goal especially in decision making of extraction and expansion.

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INTRODUCTION

The importance of facial esthetics in today's society has been well established. Esthetics has been playing a role not only in recent years but also from Egyptian and Greek times. The study of esthetics dates back to the Egyptians, who depicted ideal facial esthetics as the golden proportion. (1) This concept has been described extensively in classical art and orthodontic literature.

The 'Father of orthodontics' Edward H. Angle referred to the profile of the Greek statue of Apollo Belvedere as "a face so perfect in outline that it has been the model for students of facial art."However later he opined that using the face of Apollo Belvedere was limited in gauging the harmony of other faces. In the early 1900s Mathew Cryer, a professor of Oral Surgery at the University of Pennsylvania and Calvin Case also believed that the esthetic harmony of the face should be the most important objective in orthodontic treatment, and that extraction of teeth was sometimes necessary to achieve that goal. (2)

Recently Orthodontic treatment objectives are aimed at three types of esthetics, Macro esthetics, Mini esthetics and Micro esthetics(3).

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Macro esthetics attempts to identify and analyze the relationship and ratio between anterior teeth and surrounding tissue landmark. Mini Esthetics consideration includes smile type, smile arc and buccal corridors. Micro esthetics includes tooth proportions, connectors area & embrasures, tooth shade &color gingival height, shape & contours (4). Hence, orthodontic treatment must incorporate various esthetic elements to achieve desirable results Since Smile plays an important role in esthetics, one of the most important 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. Hence it is reasonable to analyze smile as important criteria for diagnosis and orthodontic treatment planning. Smile has eight components which are lip line, smile arc, upper lip curvature, buccal corridor, smile symmetry, frontal occlusal plane, dental components, gingival components. All of which contributes to balanced smile.(5)

Many studies have been conducted to evaluate the various smile components. Frush and Fischer demonstrated that the presence of buccal corridors added the illusion of a natural dentition, whereas its absence gave the patient an artificial appearance. Studies have shown that minimal buccal corridor is a preferred esthetic feature in both men and women and large buccal corridors should be included in the problem list

during orthodontic diagnosis and treatment planning [6]. Ackerman and Ackerman developed a ratio called the smile index used to visualize and quantify the frontal smile.[7] This ratio is used for comparing smiles among patients. The lower the smile index the less youthful the smile appears. Orthodontists have to make every effort to develop a harmonious balance between the various soft and hard tissue structures that will produce an attractive smile. This will be possible only when they are aware of the principles that manage the balance between the teeth and soft tissues during a person's smiles.

The objective of this study is to analyze buccal corridor index, smile index and smile breadth of individuals with pleasing smile, so that these parameters can be standardized for orthodontic treatment and planning

MATERIAL AND METHODS

The purpose of the study was to evaluate the static norms for various smile parameters in growing and non- growing individuals, and to analyze and quantify the sexual dimorphism of smile parameters. For this purpose photograph of 200 individuals were taken from local population. Written consent from the individuals and the parents (in case of minors) were taken before proceeding with the study.

These individuals were divided into 2 groups:

Group A - 100 growing individuals out of which 50 were males individuals and 50 were females individuals

Group B - 100 non growing individuals out of which 50 were males individuals and 50 were females individuals.

Inclusion Criteria

Extraloral

No facial asymmetry, Smile symmetry present, Well proportioned upper and lower facial height, Straight profile, Normo-divergent face pattern, Competent lips, Average upper lip line with 75% - 100% maxillary teeth exposure on smiling, Consonant smile with positive upper lip curvature

Intra oral

Class I molar relationship, Complete permanent dentition except for 3rd molar, No crowding in upper arch and minimal crowding acceptable in lower arch, No other oral pathology, No missing teeth, No supernumerary teeth, Absence of periodontal disease, No proclination of maxillary incisor, No cant in frontal occlusal plane , No midline deviation

History

No history of orthodontic treatment, No history of periodontal treatment except scaling and root planning, No history of prosthetic treatment.

Standarization and Calibration of Photograph: Clinically measurement between two point subnasale to soft tissue menton during smile were taken for calibrating the photograph in the software.

Static photographs with posed smile in natural head position (NHP) were taken. All photographs were taken in a similar environment and lighting conditions using canon 700 DSLR camera which was mounted on a tripod stand at a fixed distance of 20 inches Focal length of 38 mm was set. The lens was positioned parallel to the true perpendicular of the face in natural head position and the camera were raised to the level of individuals's lower facial third.

The individuals were asked to say "cheese" and then smile. Vertically, the photographs cropped from sub nasale and soft-tissue pogonion. Horizontally, the photographs were cropped by drawing a tangent on both the sides of the face at the zygomatic prominence.

Fig1 Static photographs with posed smile taken in natural head position (NHP)

Fig 2 Photograph cropped vertically from sub nasale and soft-tissue pogonion and and horizontally by drawing a tangent on both the sides of the face at the zygomatic prominence.

The images were transferred to computer software (KLONK image measurement 15.1.1) and then the images were calibrated taking two points subnasale and soft tissue menton. The distance between these two points were calibrated equal to the clinical measurement. After calibration, the measurements taken for the study were as follows:

- Visible maxillary dentition width (*A*) distance between the most posterior visible tooth of one side to the contralateral side[5]
- Inner commissure width (*B*) inner corner of the lips on one side to the same point on the contralateral side.[5]
- Outer commissure width (*C*) outer corner of the lips on one side to the same point on the contralateral side.[5]
- Bizygomaticwidth (*D*) between the mostlateral points on the external surfaces of the zygomatic arch. [5]
- Inter labial gap (E) the distance in mm between the upper and lower lips at midline.

In addition to the linear measurements following ratios were derived

These Ratios are as follows

- ***Buccal corridor ratio-*** a ratio of dark space at the corner of the mouth and inner commissure width (B-A/B)
- ***Smile index*** - a ratio of inner commissure width and inter labial gap (B/E)
- ***Smile breadth*** - a ratio of outer commissure width and bizygomatic width (C/D)

All these linear measurements were taken on every individuals photograph, ratios were derived and sent for statistical analysis.

Color Plate 1

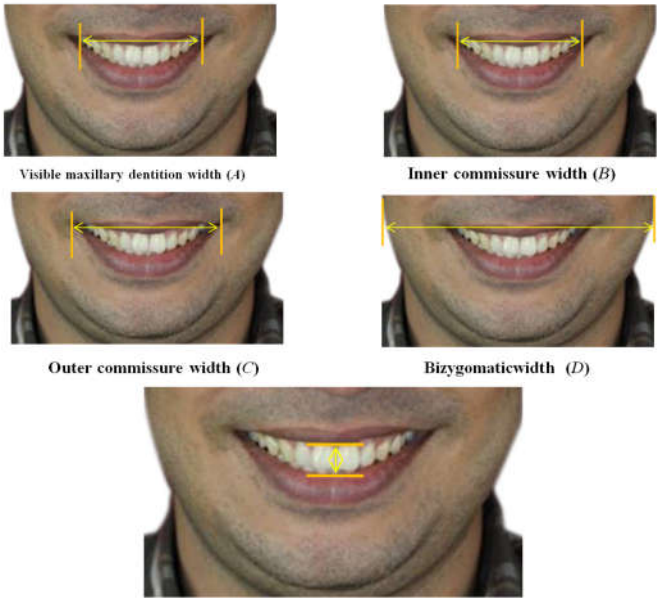

Fig 3 Inter labial gap (E)

Genderwise comparison of GROUP A and GROUP B

There was no statistically significant difference found in interlabial gap and smile breadth of growing and non growing males for P value < 0.001

In growing and non growing females there was statistically significant difference found only in buccal corridor space and buccal corridor ratio for P value < 0.001

RESULTS

Table 2

Genderwise comparison of various smile parameters among growing Individuals using Independent Student t Test

Study Parameters	Group	N	Mean	SD	S.E.M	Mean Diff	t	P-Value
Vis. Max. width	G MALES	50	47.76	5.29	0.75	-0.06	-0.068	0.95
	G FEMALES	50	47.82	3.53	0.50			
Inner commissure width	G MALES	50	51.50	5.63	0.80	-0.53	-0.550	0.58
	G FEMALES	50	52.02	3.73	0.53			
Outer commissure width	G MALES	50	58.21	5.22	0.74	-0.73	-0.704	0.48
	G FEMALES	50	58.94	5.22	0.74			
Bizyomatic width	G MALES	50	118.25	7.79	1.10	-0.44	-0.248	0.80
	G FEMALES	50	118.69	9.65	1.36			
Inter labial gap	G MALES	50	10.09	2.34	0.33	1.38	3.530	0.001*
	G FEMALES	50	8.71	1.47	0.21			
Buccal corridor space	G MALES	50	3.74	1.51	0.21	-0.46	-1.616	0.11
	G FEMALES	50	4.20	1.36	0.19			
Buccal corridor ratio	G MALES	50	0.072	0.027	0.004	-0.01	-1.603	0.11
	G FEMALES	50	0.081	0.025	0.003			
Smile index	G MALES	50	5.309	1.043	0.148	-0.86	-3.549	0.001*
	G FEMALES	50	6.167	1.355	0.192			
Smile breadth	G MALES	50	0.492	0.033	0.005	0.00	-0.761	0.45
	G FEMALES	50	0.497	0.028	0.004			

Table 4

Genderwise comparison of various smile parameters among Non-growing Individuals using Independent Student t Test

Study Parameters	Group	N	Mean	SD	S.E.M	Mean Diff	t	P-Value
Vis. Max. width	NG MALES	50	53.36	5.49	0.78	6.59	6.698	<0.001*
	NG FEMALES	50	46.78	4.27	0.60			
Inner commissure width	NG MALES	50	58.27	5.62	0.79	5.42	4.930	<0.001*
	NG FEMALES	50	52.85	5.38	0.76			
Outer commissure width	NG MALES	50	65.70	6.51	0.92	5.57	4.407	<0.001*
	NG FEMALES	50	60.13	6.12	0.86			
Bizyomatic width	NG MALES	50	135.30	12.59	1.78	13.17	5.464	<0.001*
	NG FEMALES	50	122.13	11.48	1.62			
Inter labial gap	NG MALES	50	9.39	1.45	0.20	0.56	1.759	0.08
	NG FEMALES	50	8.84	1.70	0.24			
Buccal corridor space	NG MALES	50	4.90	0.81	0.11	-1.17	-4.103	<0.001*
	NG FEMALES	50	6.07	1.84	0.26			
Buccal corridor ratio	NG MALES	50	0.085	0.014	0.002	-0.03	-6.560	<0.001*
	NG FEMALES	50	0.114	0.028	0.004			
Smile index	NG MALES	50	6.322	0.990	0.140	0.05	0.264	0.79
	NG FEMALES	50	6.271	0.925	0.131			
Smile breadth	NG MALES	50	0.486	0.027	0.004	-0.01	-1.180	0.24
	NG FEMALES	50	0.493	0.031	0.004			

Table 5

Comparison of various smile parameters between Growing and Non-growing Male Individuals using Independent Student t Test								
Study Parameters	**Group**	**N**	**Mean**	**SD**	**S.E.M**	**Mean Diff**	**t**	**P-Value**
Vis. Max. width	Growing	50	47.76	5.29	0.75	-5.61	-5.198	<0.001*
	Non-Growing	50	53.36	5.49	0.78			
Inner commissure width	Growing	50	51.50	5.63	0.80	-6.77	-6.022	<0.001*
	Non-Growing	50	58.27	5.62	0.79			
Outer commissure width	Growing	50	58.21	5.22	0.74	-7.49	-6.350	<0.001*
	Non-Growing	50	65.70	6.51	0.92			
Bizyomatic width	Growing	50	118.25	7.79	1.10	-17.04	-8.140	<0.001*
	Non-Growing	50	135.30	12.59	1.78			
Inter labial gap	Growing	50	10.09	2.34	0.33	0.70	1.800	0.08
	Non-Growing	50	9.39	1.45	0.20			
Buccal corridor space	Growing	50	3.74	1.51	0.21	-1.17	-4.825	<0.001*
	Non-Growing	50	4.90	0.81	0.11			
Buccal corridor ratio	Growing	50	0.072	0.027	0.004	-0.01	-2.860	0.005*
	Non-Growing	50	0.085	0.014	0.002			
Smile index	Growing	50	5.309	1.043	0.148	-1.01	-4.977	<0.001*
	Non-Growing	50	6.322	0.990	0.140			
Smile breadth	Growing	50	0.492	0.033	0.005	0.01	1.040	0.30
	Non-Growing	50	0.486	0.027	0.004			

Table 6

Comparison of various smile parameters between Growing and Non-growing Female Individuals using Independent Student t Test								
Study Parameters	Group	N	Mean	SD	S.E.M	Mean Diff	t	P-Value
Vis. Max. width	Growing	50	47.82	3.53	0.50	1.04	1.333	0.19
	Non-Growing	50	46.78	4.27	0.60			
Inner commissure width	Growing	50	52.02	3.73	0.53	-0.83	-0.892	0.37
	Non-Growing	50	52.85	5.38	0.76			
Outer commissure width	Growing	50	58.94	5.22	0.74	-1.19	-1.048	0.30
	Non-Growing	50	60.13	6.12	0.86			
Bizyomatic width	Growing	50	118.69	9.65	1.36	-3.44	-1.621	0.11
	Non-Growing	50	122.13	11.48	1.62			
Inter labial gap	Growing	50	8.71	1.47	0.21	-0.12	-0.388	0.70
	Non-Growing	50	8.84	1.70	0.24			
Buccal corridor space	Growing	50	4.20	1.36	0.19	-1.87	-5.772	<0.001*
	Non-Growing	50	6.07	1.84	0.26			
Buccal corridor ratio	Growing	50	0.081	0.025	0.003	-0.03	-6.217	<0.001*
	Non-Growing	50	0.114	0.028	0.004			
Smile index	Growing	50	6.167	1.355	0.192	-0.10	-0.447	0.66
	Non-Growing	50	6.271	0.925	0.131			
Smile breadth	Growing	50	0.497	0.028	0.004	0.00	0.698	0.49
	Non-Growing	50	0.493	0.031	0.004			

DISCUSSION

The importance of beauty and attractiveness in today's society has been well established. Smile plays an important role in facial expression and appearance. Several studies have been conducted using photographs and they denote that higher intellectual and social abilities were attributed to individuals with good esthetics. One of the most important objectives of orthodontic treatment is to improve facial attractiveness, which is achieved by the enhancement of dental and smile esthetics.

Studies have been done on various smile parameters of smile to establish the norms of ideal smile. Smile has eight components which are lip line, smile arc, upper lip curvature, buccal corridor, smile symmetry, frontal occlusal plane, dental components, gingival components.[5]In the present study buccal corridor ratio, smile index, and smile breadth were derived in esthetically pleasing growing and non-growing individuals.

Our study concluded that the people who are having esthetically pleasing smile have less buccal corridor ratio. There was significant difference between non-growing male individuals and non-growing female individuals but no significant difference found between growing males and growing females individuals.

The mean score of buccal corridor ratio in non- growing male individuals was 8.5 % and in non- growing female individuals was 10.5 % whereas in growing malesindividualswas7.2 % and in growing females individuals was 8.1 % . Non-growing males individuals were having less buccal corridor ratio as compare to non- growing females individuals and growing males individuals were having less buccal corridor ratio as compare to growing females individuals. Growing individuals were having less buccal corridor ratio as compare to non – growing individuals.

The results of this study are in agreement with the sudy done by Parekh *et al* [8]who found that excessive buccal corridor and smile arcs were rated less attractive by both orthodontist and layperson. Our findings are also in agreement with HumaKiani *et al*[9]who showed that broader smiles with minimum buccal corridor space were preferred by both orthodontist and laypersons. The findings of our study are not in accordance with the study done by Diana Cunha *et al*[10] who considered 16 % buccal corridor ratio as the most pleasant one. The reason for that may be attributed to the fact that they have taken the distance between outer commissure width for measuring the buccal corridor ratio whereas in our study the distance between inner commissure was taken.

In present study, the mean score of smile index in non-growing male was 6.322 mm and in non-growing female was 6.271

mm. The mean score of smile index in growing males was 5.309 mm and in growing females was 6.167 mm. There was no statistically significant difference between non-growing male and non-growing female, but there was statistically significant difference growing males and growing females. The results of the study are in accordance by Parekh *et al*[8]who found the smile index was 6.0212mm.

In the present study smile index is more for non- growing individuals as compared to growing individuals which is supported by Desai *et al*.[11]According to their study the smile index significantly increased with age. This data provides evidence that, as a person ages, the smile tends to get relatively wider transversely and narrower vertically. This canbe attributed to activity and function of the muscles involved in smile decrease with age. The findings of our study are also supported by Chetan *et al*.[12]

The mean score of smile breadth in non-growing male was 0.486 mm and in non-growing female individuals was 0.493 mm. There was statistically significant difference between non-growing male and non-growing female. The mean score of smile breadth in growing males was 0.492 mm and in growing females was0.497 mm. There was no statistically significant difference between growing males and growing females individuals. In the present study smile breadth was more for growing individuals as compare to non-growing individuals.

Though our study has derived the smile parameters of growing and non – growing individuals, it was limited on virtue of being a cross-sectional study. Longitudinal data derived from dynamic smile recording of growing individuals would provide a better insight into the smile parameters and their changes with age.

CONCLUSION

The conclusion of our study were as follows:

1. Visible maxillary posterior teeth width increased with age inmales and slightly decreased in female.
2. Inner commissure and outer commissure width in esthetically pleasing individuals increased with age.
3. Bi-zygomatic width in esthetically pleasing individuals increased with age.
4. Inter-labial gap was decreased in esthetically pleasing male and slightly increased in females.
5. Buccal corridor ratio in esthetically pleasing non-growing male was 8.5 %, in non –growing female was 10.5%, in growing male was 7.2 % and in growing female was 8.1%.Buccal corridor ratio increased with age. Females individuals were having more buccal corridor ratio as compared to males.
6. Smile index increased with age which indicates that smile tends to get relatively wider transversely and narrower vertically. Females were having more smile index as compared to males.
7. Smile breadth decreased with age which indicates bi-gygomatic width increases more as compare to outer commissure width. Females were having more smile breadth as compare to males.
8. Our treatment goal should be to achieve the smile parameters that are ideal or closer to these values for optimal smile esthetics.

Clinical Implications

1. Less buccal corridor space has been preferred in esthetically pleasing smile, which should be considered during treatment planning involving extraction or expansion.
2. In non growing individuals buccal corridor space was more as compare to growing individuals, which can be attributed to increase in inner-commissure width with age.
3. In our study, smile index of esthetically pleasing individualsindicates that the width of inner commissure is almost six times than that of inter labial gap.
4. Smile index increases with age which indicates the smile tends to get relatively wider transversely and narrower vertically.
5. Smile breadth of esthetically pleasing individuals indicates that the width of outer commissure width is almost 50% of bi zygomatic width.
6. These important esthetic parameters must be considered in determining and executing appropriate individual treatment goal especially in decision making of extraction and expansion

References

1. Singh VP *et al*, Principles of Smile Analysis in Orthodontics- A Clinical Overview, Singh VP *et al* Health Renaissance, January-April 2011; Vol 9 (No.1);35-40
2. Patrick K. Turley, Evolution of esthetic consideration in orthodontics *Am J OrthodDentofacialOrthop* 2015; 148:374-9)
3. Kokich VO fr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. J Esthet Dent 11:311-324, 1999.
4. Hulsey CM. An esthetic evaluation of lip-teeth relationships present in the smile. *Am J OrthodDentfacialOrhop*. 57:132-144, 1970.
5. ROY SABRI, eight components of balanced smile JCO 2005 march
6. Moore T, Southard KA, Casko JS, Qian F, Southard TE. Buccal corridors and smile esthetics. *Am J OrthodDentofacialOrthop* 127:208-213, 2005
7. Ackerman *et al*, smile analysis and design in digitial era, JCO 2002 vol36 no.4
8. Parekh l, Fields HW, Beck FM, Rosenstiel S. Attractiveness of variations in the smile arc and buccal corridor space as judged by orthodontists and laymen, Angle Orthod 76:557 -563,2006.
9. HumaKiania, UlfatBahirb, Owais Khalid Durranic, KanwalZulfiqard, Comparison of difference in perception between Orthodontists and laypersons in terms of variations in buccal corridor space using Visual Analogue Scale, POJ 2013:5(2) 67-72
10. Diana Cunha Nascimento, Êmeli Rodrigues dos Santos, Andre Wilson Lima Machado, Marcos Alan Vieira Bittencourt4 Influence of buccal corridor dimension on smile esthetics, *Dental Press J Orthod*. 2012 Sept-Oct;17(5):145-50
11. Shyam Desai, MadhurUpadhyay, and Ravindra NandaDynamic smile analysis: Changes with age Am J *OrthodDentofacialOrthop* 2009;136:310.e1-310.10
12. PatilChetana, Pradeep Tandonb, Gulshan K. Singhc, AmitNagard, Veerendra Prasade; Vinay K. Chugh, Dynamics of a smile in different age groups Angle Orthod. 2013;83:90-96