Original Research Paper

University J Dent Scie 2020; Vol. 6, Issue 3

A photogrammetric and cephalometric evaluation of facial symmetry and smile in relation to attractiveness.

ABSTRACT

Introduction: Human find symmetrical face more attractive than are asymmetrical faces.The smile is one of the most important facial expressions and is essential in expressing friendliness, agreement, and appreciation.The aim of the present study was to evaluate the relationship between smile and symmetry in attributing to attractiveness.

Materials & Method: The study was conducted in the Department Of Orthodontics and Dentofacial Orthopedics, on150 samples.150 good quality radiographs and photographs of the patients were obtained. The subjects were divided into three groups:Group I – Horizontal growth pattern Group II – Average growth pattern Group III – Vertical growth pattern. The frontal facial photograph and PA cephalometric radiograph were used to assess the facial symmetry. Posed smile photograph and Lateral cephalometric radiograph were used to assess the smile. Digimizer Image Analyzer (bvba software) were used for the analysis. The ratings were given by the expert panellist based on attractiveness

Results: In the present study, Left facial symmetry parameters is marginally higher than right side in cephalometric analysis and converse for photographic analysis, right facial symmetry parameters is marginally higher than left side but this is not statistically significant. Thereare no statistically significant difference among the groups for smile -photographic parameters and lateral cephalometric smile parameters.There is statistically significant difference among the groups for Visual Analog Scale readings for attractiveness given by orthodontist, general dentist and layperson for frontal profile for the subjects of three study groups.

Conclusion: The study revealed that in cephalometric analysis, left hemiface is wider than right hemiface while in photographic analysis, right hemiface is wider than left hemiface. Vertical grower shows maximum upper incisor exposure and upper and lower vermilion lip thickness. On the contrary full smile length was minimum in vertical grower. The most favored profile by VAS was horizontal growth pattern.

Key Words: Symmetry, Smile, Attractiveness

Introduction:

Human find symmetrical face more attractive than are asymmetrical faces. Evolutionary psychologist claims that our symmetry can be explained in contest of mate choice because symmetry is an honest indicator of genetic quality of potential mates.[1]Psychologist have long been interested in the cognitive mechanisms and adaptive significance of facial attractiveness.[2]

The smile is one of the most important facial expressions and is essential in expressing friendliness, agreement, and appreciation. An attractive or pleasing smile clearly enhances the acceptance of an individual in the society by improving the initial impression in interpersonal relationships.[3]

Access this article online	
Website: www.ujds.in	Quick Response Code
DOI: https://doi.org/10.21276/ujds.2020.6.3.1	

The purpose of this study was to assess facial symmetry, smileandfacial esthetics in different facial growth patternsand correlate them with underlying hard tissue structure.

[1]AKSHITA, [2]CHAUHAN, A. K., [3]CHAWLA, R.

[1]Shree Bankey Bihari Dental College, Ghaziabad

[2]Kothiwal Dental College and Research Centre, Moradabad.

[3]Dept. of Orthodontics, International Faculty of Dental Medicine of Rabat, Morocco

Address for Corresponding : Dr. Riddhi Chawla Department of Orthodontics, International Faculty of Dental Medicine of Rabat, Morocco

Email : riddhichawla@yahoo.co.in

Received : 18 August 2020, **Published :** 31 Dec. 2020

How to cite this article: Akshita, Chauhan, A. K., & Chawla, R. (2021). A photogrammetric and cephalometric evaluation of facial symmetry and smile in relation to attractiveness. UNIVERSITY JOURNAL OF DENTAL SCIENCES, 6(3). https://doi.org/10.21276/ujds.2020.6.3.1: 01-8

Method And Material:

The 150 sample were selected from the students of a dental college. Good quality radiographs (lateral and posterior-anterior radiographs) and photographs (frontal and posed smile) of the patients were obtained using a digital camera based on following criteria:

Inclusion criteria: Subjects were in the age group of 18-25years, there should be no missing except 3rd molars or malformed teeth causing a tooth size discrepancy, subjects should have a clinically acceptable smile and a good profile and Class-I molar relation.

Exclusion criteria: Subjects with congenital anomaly or craniofacial defect, clinically evident skeletal asymmetry or cross bite.

The subjects were divided into three groupsbased on SN-MP(Table 1).

Table 1 Various Groups14

Group I – Horizontal growth pattern	Group II – Average growth pattern	Group III – Vertical growth pattern
25°-29°	30°-34°	35°-39°

All photographs were taken under same lightening conditions, magnification and at a fixed distance.

Symmetry Analysis1

The frontal facial photograph were used to assess the facial symmetry using following attribute(Figure 1):

P1- right outer canthus, P2- left outer canthus, P3- right inner canthus, P4- left outer canthus, P5- right zygomatic arch, P6- left zygomatic arch, P7- right alar process, P8- left alar process, P9- right chelion, P10- left chelion, P11- right gonion, P12- left gonion, P13- menton, P14- subnasion.

Mid sagittal plane (MSP) was formed by joining P13 and P14 and was used as a reference line for assessing facial symmetry. The distance of various left and right-side points were measured from MSP using Digimizer Image Analyzer software.

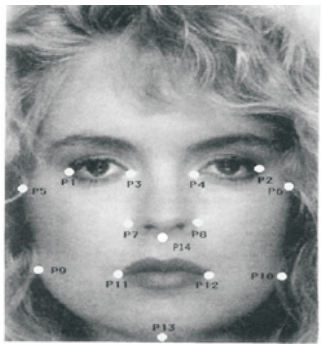

Figure 1: Points used in study

Postero-anterior Cephalometric Parameters4

Linear Asymmetry 4-Z-MSP, Co-MSP, J-MSP, Ag-MSP, Me-MSP

Mandibular Asymmetry 4- Co-Ag, Ag-Me, Co-Me

Smile Analysis5

Digimizer Image Analyzer (bvba software) were used to analyze the smile. The following attributes of the smile were measured in millimeters:Max Incisor Exposure, Upper vermillion Lip Thickness, Lower Vermillion Lip Thickness, Full Smile Length.

For the correlation of the cephalometric analysis with the smile analysis, following measurements were used:

Angles5

SNA, SNB, U1-SN, SN-MP, SN-PP, L1-MP

Linear Measurement5

Pt A- N perp, Pog – N perp, U1 – Pt A (Horizontal), U1 –Pt A (Vertical), U1 – PP (Vertical), N- Me, ANS-Me

Attractiveness were assessed on the basis of visual analogue scale.The ratings were given by the expert panelist based on attractiveness. The rating were given from 1-5 from very unattractive to very attractive.

Statistical analysis:

Linear and area measurements were compared by two factor analysis of variance (ANOVA) and the significance of mean difference within (intra) and between (inter) the groups was done by Tukey's post hoc test.A two-tailed $p<0.05$ was considered statistically significant. Analyses were performed on SPSS software (Window version 17.0).

Results:

Table 2 Group comparison of Smile parameters using ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
SNA	Between Groups	25.653	2	12.827	.577	.563
	Within Groups	3265.740	147	22.216		
	Total	3291.393	149			
SNB	Between Groups	23.790	2	11.895	.609	.545
	Within Groups	2873.210	147	19.546		
	Total	2897.000	149			
UI- SN	Between Groups	196.163	2	98.082	2.080	.129
	Within Groups	6930.310	147	47.145		
	Total	7126.473	149			
PP- SN	Between Groups	5.320	2	2.660	.356	.701
	Within Groups	1098.340	147	7.472		
	Total	1103.660	149			
LI- MP	Between Groups	49.053	2	24.527	.407	.666
	Within Groups	8854.520	147	60.235		
	Total	8903.573	149			
Pt A- N perp	Between Groups	.303	2	.152	.064	.938
	Within Groups	350.070	147	2.381		
	Total	350.373	149			
Pog – N perp	Between Groups	6.943	2	3.472	.283	.754
	Within Groups	1802.350	147	12.261		
	Total	1809.293	149			
UI- Pt A (Horizontal)	Between Groups	7.053	2	3.527	.707	.495
	Within Groups	733.240	147	4.988		
	Total	740.293	149			
UI- Pt A (Vertical)	Between Groups	37.889	2	18.944	.922	.400
	Within Groups	3020.283	147	20.546		
	Total	3058.172	149			
N- Me	Between Groups	80.253	2	40.127	.795	.453
	Within Groups	7416.420	147	50.452		
	Total	7496.673	149			
ANS – Me	Between Groups	126.093	2	63.047	1.613	.203
	Within Groups	5745.240	147	39.083		
	Total	5871.333	149			

Table 2 shows inter group comparison of lateral cephalometric smile parameters using ANOVA. It shows that there is no statistically significant difference among the groups

Table 3Group comparison of facial symmetry parameters using ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Rt Z- MSP	Between Groups	20.070	2	10.035	.944	.391
	Within Groups	1562.690	147	10.631		
	Total	1582.760	149			
lt Z- MSP	Between Groups	12.653	2	6.327	.494	.611
	Within Groups	1884.180	147	12.818		
	Total	1896.833	149			
Rt Co – MSP	Between Groups	39.960	2	19.980	1.299	.276
	Within Groups	2260.680	147	15.379		
	Total	2300.640	149			
lt Co – MSP	Between Groups	7.960	2	3.980	.287	.751
	Within Groups	2038.200	147	13.865		
	Total	2046.160	149			
rt J – MSP	Between Groups	.373	2	.187	.039	.962
	Within Groups	701.200	147	4.770		
	Total	701.573	149			
lt J – MSP	Between Groups	2.080	2	1.040	.136	.873
	Within Groups	1125.980	147	7.660		
	Total	1128.060	149			
rt Ag – MSP	Between Groups	23.413	2	11.707	.500	.608
	Within Groups	3442.060	147	23.415		
	Total	3465.473	149			
lt Ag – MSP	Between Groups	12.653	2	6.327	.305	.738
	Within Groups	3053.320	147	20.771		
	Total	3065.973	149			
rt Me – MSP	Between Groups	.213	2	.107	.153	.858
	Within Groups	102.160	147	.695		
	Total	102.373	149			
lt Me – MSP	Between Groups	.173	2	.087	.120	.887
	Within Groups	106.420	147	.724		
	Total	106.593	149			
rt Co-Ag	Between Groups	22.573	2	11.287	.158	.854
	Within Groups	10533.300	147	71.655		
	Total	10555.873	149			
Lt Co-Ag	Between Groups	17.440	2	8.720	.131	.877
	Within Groups	9776.700	147	66.508		
	Total	9794.140	149			
Rt Ag – Me	Between Groups	18.013	2	9.007	.543	.582
	Within Groups	2440.280	147	16.601		
	Total	2458.293	149			
lt Ag – Me	Between Groups	41.293	2	20.647	.640	.529
	Within Groups	4745.300	147	32.281		
	Total	4786.593	149			
Rt Co – Me	Between Groups	35.453	2	17.727	.306	.737
	Within Groups	8525.320	147	57.995		
	Total	8560.773	149			
Lt Co – Me	Between Groups	28.093	2	14.047	.223	.800
	Within Groups	9254.900	147	62.959		
	Total	9282.993	149			

Table 3 shows inter group comparison of facial symmetry parameters using ANOVA. It shows that there is no statistically significant difference among the groups

Table 4 Group comparison for linear measurement facial symmetry photograph using ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
P1 – MSP	Between Groups	36.275	2	18.137	1.511	.224
	Within Groups	1764.624	147	12.004		
	Total	1800.898	149			
P2 – MSP	Between Groups	29.035	2	14.517	1.016	.365
	Within Groups	2100.755	147	14.291		
	Total	2129.790	149			
P3 – MSP	Between Groups	13.266	2	6.633	2.443	.090
	Within Groups	399.113	147	2.715		
	Total	412.379	149			
P4 – MSP	Between Groups	7.143	2	3.571	1.177	.311
	Within Groups	446.112	147	3.035		
	Total	453.255	149			
P5 – MSP	Between Groups	11.702	2	5.851	.268	.765
	Within Groups	3210.921	147	21.843		
	Total	3222.623	149			
P6 – MSP	Between Groups	15.520	2	7.760	.329	.720
	Within Groups	3471.422	147	23.615		
	Total	3486.942	149			
P7 – MSP	Between Groups	.758	2	.379	.111	.895
	Within Groups	502.968	147	3.422		
	Total	503.726	149			
P8 – MSP	Between Groups	3.777	2	1.888	.624	.537
	Within Groups	444.874	147	3.026		
	Total	448.651	149			
P9 – MSP	Between Groups	40.102	2	20.051	.500	.608
	Within Groups	5898.145	147	40.123		
	Total	5938.247	149			
P10 - MSP	Between Groups	66.656	2	33.328	.795	.454
	Within Groups	6163.479	147	41.928		
	Total	6230.135	149			
P11 - MSP	Between Groups	1.796	2	.898	.168	.845
	Within Groups	785.155	147	5.341		
	Total	786.950	149			
P12 – MSP	Between Groups	.003	2	.001	.000	1.000
	Within Groups	727.371	147	4.948		
	Total	727.374	149			

Table4 describes the inter group comparison for linear measurement facial symmetry- photographs parameters using ANOVA. It shows that there is no statistically significant difference among the groups

Table5 Group comparison for smile parameters photographic using ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Maximum Incisor Exposure	Between Groups	5.274	2	2.637	1.438	.241
	Within Groups	269.546	147	1.834		
	Total	274.820	149			
Upper Vermillion Lip Thickness	Between Groups	3.218	2	1.609	.625	.537
	Within Groups	378.446	147	2.574		
	Total	381.664	149			
Lower Vermillion Lip Thickness	Between Groups	4.158	2	2.079	.624	.537
	Within Groups	489.899	147	3.333		
	Total	494.056	149			
Full Smile Length	Between Groups	61.755	2	30.878	.855	.427
	Within Groups	5307.870	147	36.108		
	Total	5369.625	149			

Table5 describes inter group comparison for smile -photographic parameters using ANOVA
It shows that there is no statistically significant difference among the groups.

Table 6 Group comparison for VAS scores using ANOVA

			Sum of Squares	Df	Mean Square	F	Sig.
ORTHODONTIST	FRONTAL	Between Groups	1.973	2	.987	2.313	.103
		Within Groups	62.720	147	.427		
		Total	64.693	149			
	SMILING	Between Groups	1.480	2	.740	1.701	.186
		Within Groups	63.960	147	.435		
		Total	65.440	149			
GENERAL DENTIST	FRONTAL	Between Groups	1.480	2	.740	1.701	.186
		Within Groups	63.960	147	.435		
		Total	65.440	149			
	SMILING	Between Groups	1.973	2	.987	2.313	.103
		Within Groups	62.720	147	.427		
		Total	64.693	149			
LAYPERSON	FRONTAL	Between Groups	1.973	2	.987	2.313	.103
		Within Groups	62.720	147	.427		
		Total	64.693	149			
	SMILING	Between Groups	1.480	2	.740	1.701	.186
		Within Groups	63.960	147	.435		
		Total	65.440	149			

Table 6 shows group comparison for VAS readings for attractiveness given by orthodontist, general dentist and layperson for frontal and smiling profile using ANOVA. It showsthat there is statistically significant difference among the groups.

Discussion:

Perfectly bilateral face and body is largely a theoretical concept that seldom exists. Right-left differences occur everywhere in nature where two bilateral congruent parts presents in an entity.[6]

Smile analysis and design have become key elements of orthodontic diagnosis and treatment planning.In the evolution of orthodontics, the changes in the soft tissue attract a considerable attention.[7]

All images have some degree of asymmetry which can be attributed to (a) Each half of our brain has a different function (b) The chance is almost zero that all milliards of cells that build our faces will be distributed in a complete symmetry from our birth to death.[8]

Cephalometric and Photographic Symmetry Parameters:

All the parameters were slightly higher on left side than on right side except Me – MSP which was higher on right side than on left side.

Most studies of normal asymmetry have reported the reverse relation.[1,9] However, some reports have found the left hemiface to be wider.[10,11] In this study, leftsidewas marginally higher than Rightside incontrary to Simmons et al1 and Haraguchi et al9 whereas above finding is supported by the study done by Vig et al10and Chebib et al.[11]

The study conducted by Farkas et al12shows that most common and large asymmetries were found in upper third of face which is seen in the present study.

Cephalometric and Photographic Smile Parameters:

Maximum incisor exposure-The incisal display significantly increased from average to horizontal to vertical facial growth pattern. Contrary to this, McNamara et al.13 found that the vertical display on smile of the maxillary right central incisor could not be correlated with the skeletal vertical dimension.

Upper Vermilion lip thickness–Upper Vermillion Lip Thickness is maximum in vertical growth pattern and minimum in horizontal growth pattern.However, Grover et al14showed opposite results.

Lower Vermilion lip thickness –The Lower Vermillion Lip Thickness is maximum in vertical growth pattern and minimum in horizontal growth pattern.

Full smile Length –The Full smile length was maximum in average growth pattern and minimum in vertical growth pattern. The similar results wereobserved by Grover et al14. This was contrary to the results of Rigsbee et al.15 and Chetan et al.[7]

Visual Analog Scale :

In this study there is high significant difference in the profile and smiling photograph in average growth pattern by layman and orthodontist. The study done by Rai et al5 showed a statistically high significant difference between the perception of the smile by the orthodontist and layperson. The most favored profile by VAS was horizontal growth pattern, followed by vertical growth pattern and average growth pattern. This is similar to finding done by Lundstrom et al16

Conclusion:

The following conclusion can be drawn:

1. In cephalometric analysis, left hemiface is wider than right hemiface while in photographic analysis, right hemiface is wider than left hemiface. There was strong correlation seen among skeletal symmetry and soft tissue parameters. Soft tissue camouflaged the underling hard tissue.
2. Vertical grower shows maximum upper incisor exposure and upper and lower vermilion lip thickness. On the contrary full smile length was minimum in vertical grower.
3. The most favored profile by VAS was horizontal growth pattern.

References:

1. Simmons LW, Rhodes G, Peters M, Koehler N. Are human preferences for facial symmetry focused on signals of developmental instability. Behavioral Ecology 2004;15:864-871.
2. Perrett DI, Burt DM, Penton-Voak IS, Lee KJ, Rowland DA, Edwards R. Symmetry and human facial attractiveness. Evolution and human behavior 1999;20:295-307.
3. Krishnan V, Daniel ST, 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 Orthop2008;133:515-23.
4. Grummons DC. A frontal asymmetry analysis. JCO 1987;21:448-465.
5. Rai D, Janardhanam P, Rai A. Esthetic factors of smile in vertical dimensions: A comparative evaluation. J Indian Orthod Society 2015;49:25-31.
6. Cheong YW, Lo LJ. Facial Asymmetry: Etiology, Evaluation, and Management. Chang Gung Med J 2011;34:341-51.
7. Chetan P, Tandon P, Singh GK, Nagar A, Prasad V, Chugh VK. Dynamics of a smile in different age groups. Angle Orthod.2013;83:90–96.
8. Tamir, Abraham MD. Quantitative Analysis of Face Symmetry. J Craniofacial Surgery 2015;26:1268-1269.
9. Haraguchi S, Iguchi Y, Takada K. Asymmetry of the Face in Orthodontic Patients. Angle Orthod 2008; 78: 421-426.
10. Vig PS, Hewitt AB. Asymmetry of the human facial skeleton. Angle Orthod. 1975;45:125–129.
11. Chebib FS, Chamma AM. Indices of craniofacial asymmetry.AngleOrthod. 1981;51:214–226.
12. Farkas LG, Cheung G. Facial asymmetry in healthy North American caucasians. Angle Orthod. 1981; 61:70–77.
13. McNamara L, McNamara Jr JA, Ackerman MB, Baccetti T. Hard- and softtissue contributions to the esthetics of the posed smile in growing patients seeking orthodontic treatment. Am J OrthodDentofacOrthop. 2008;133:491–9.
14. Grover N, Kapoor DN, Verma S, Bharadwaj P. Smile analysis in different facial patterns and its correlation with underlying hard tissues. Prog Orthod. 2015;16:28.
15. Rigsbee OH, Sperry TP, BeGole EA. The influence of facial animation on smile characteristics. Int J Adult OrthodOrthognath Surg. 1988;3:233–9.
16. Lundstrom A, Woodside DG, Popovich F. panel assessment of facial profile related to mandibular growth direction. Eur J Orthod 1987; 9:271-278.