

# Photographic Assessment of Facial Components in Facial Esthetics as Perceived by Orthodontists, Artists, and Photographers – An *In vivo* Study

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## ABSTRACT

**Background:** Facial esthetics was primarily the subject of study for artists and philosophers. Facial appearance is an essential diagnostic criterion for a complete comprehensive orthodontic treatment planning. The aim of this study was to establish the perception of facial esthetics by different professionals, namely orthodontists, artists, and photographers, and to investigate the most influential facial characteristics involved in rating the overall attractiveness. **Materials and Methods:** Twenty-two subjects of age 18–24 years fulfilling the inclusion criteria were selected as the study samples. The subjects were asked to relax, gently touch the lips together, and then start smiling. This dynamic range of smile was video recorded using a digital camera. This video was then converted into 300 frames. The frame that best represented the subjects' natural/posed unstrained social smile was selected and cropped to create three types of images: the face with the smile, the face without the smile, and the smile image. The evaluators (orthodontists, artists, and photographers) were instructed to answer the questions from 1 to 8 looking at image 1 (face with smile), question 9 by looking at image 2 (face without the smile), and questions 10 and 11 by looking at image 3 (smile only). **Results:** According to orthodontists and artists, the feature most strongly associated with overall attractiveness was symmetry of face, whereas the photographers showed the highest score for cheekbones. The highest correlation was found between the orthodontist and artist groups. **Conclusion:** The perception by the three professionals confirms that the overall facial attractiveness is more important than dental attractiveness.

**KEYWORDS:** Artist, facial esthetics, orthodontist, photographers

## INTRODUCTION

In the ever-evolving field of beauty, professionals of many fields have elaborated on their perception of esthetics. Esthetics and beauty have fascinated human beings from the very dawn of mankind, inspiring countless artists, philosophers, and scientists. Facial attractiveness is something that is intuitively perceived rather than the one measurable with instruments. Scientific research on physical attractiveness is justified because it is connected to the features of the perceiver

and the person perceived. Although in modern days a common layman's notion is that the judgments on beauty are a matter of subjective opinion, recent

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findings suggest that people might share a common taste for facial attractiveness and that their preferences may be an innate part of the primary constitution of our nature. Contemporary society plays significant emphasis on physical appearance in general and on facial attractiveness in particular.<sup>[1]</sup> Appearance has an important influence on one's social interaction with others and has a bearing on one's own self-esteem. It has been shown that people with attractive features are regarded socially as more competent, successful, and likeable.<sup>[2]</sup>

The study of facial esthetics was, earlier, primarily the subject of artists and philosophers. Today, facial appearance is an essential diagnostic criterion to be considered in comprehensive orthodontic treatment planning.<sup>[3]</sup> The goal of enhancing patient appearance requires us to revisit fundamental concepts of art and beauty that were present during the early development of orthodontic doctrine.<sup>[4]</sup> Art played an important role in Angle's orthodontic school. Wuerpel, an art professor and a visiting professor in Angle's school, taught the students about Greco-Roman sculpture and facial proportions.<sup>[5]</sup> According to Angle, more attention should be paid to his inclusion of art in the orthodontic search for quantifying facial beauty. Art instruction was an integral part of the Angle curriculum, but it has gradually disappeared from the modern residency program.<sup>[6]</sup> An interesting question within the field of orthodontics is, which facial features are determinants of these interpersonal judgments? Do we only look at the position of the teeth and eyes to estimate someone's attractiveness? Is it the teeth, the symmetry of a face, or a combination of several facial features? In order to answer this question, several researchers have focused on the importance of various facial features in the assessment of facial esthetics.<sup>[6]</sup> In investigations of facial esthetics, judgments of panels have often been compared, but conflicting results have been reported. Differences in study design may, to a large extent, be responsible for these conflicting results. In addition, factors related to the individual characteristics of the panel members such as professional background, age, gender, and geographical region may also influence the ratings. Photography is another contemporary branch dealing with facial esthetics.<sup>[7]</sup> A portrait photographer has the ability to understand the facial features of his subject which he esthetically captures to give them a pleasing photograph of themselves. The aim of this study was (i) to establish the perception of facial esthetics by different professionals, namely orthodontists, artists, and photographers and (ii) to investigate the most influential facial characteristics involved in rating overall attractiveness.

## MATERIALS AND METHODS

The study was reviewed and approved by the Institutional Review Board (approval number 200/IRB/1-19). One hundred subjects of age 18–24 years were randomly selected among the students of a dental institution, and the samples were then segregated based on the inclusion criteria. The inclusion criteria are (1) age 18–24 years, (2) no previous orthodontic or maxillofacial surgeries done, (3) complete permanent dentition, (4) no active periodontal disease and no periodontal treatment except scaling and polishing, (5) no severe malocclusion (Index of Orthodontic Treatment Need Grade 1 and 2), (6) not wearing glasses, (7) no dental or facial trauma, and (8) no congenital defect.

Twenty-two subjects fulfilling the inclusion criteria were selected as the study samples. All the subjects signed informed consent. The Evaluation Panelists belonged to three different professions: (1) orthodontist, (2) artist, and (3) photographer. The orthodontists were professors at various dental institutions. The photographers and the artists were from Ahalia Heritage Village, Palakkad, a prominent institution promoting contemporary and heritage art forms. The subjects were made to sit with the head in natural position. The vertical orientation of the head was standardized by a plumb line that was suspended to a hook on the right side of the subject. The horizontal of the floor was checked using a spirit level. The background was standardized to be white in color. The camera to patient distance was set at 1 meter. The camera was connected to a 2-strobe lighting source that illuminated the subject indirectly from a flash that reflected from a photographic umbrella. The camera was fixed on tripod stand such that the center of the lens focused on the subnasale of the subject. The subjects were asked to look straight at a distant object in natural head position (NHP). The subjects were then asked to rehearse the phrase “CHELSEA EATS CHEESECAKE ON THE CHESAPEAKE” in order to relax the muscles. The subjects were then asked to relax, gently touch the lips together, and then start smiling. This dynamic range of smile was video recorded using the digital (SLR, Canon 600D) camera. The duration of video clip for each subject was 10 s. The raw video clips of each subject were transferred to a computer, and using commercially available video editing software (GOM player), the streaming video was converted to individual photographic frames at a rate of approximately 30 frames/sec and got converted into 300 frames. The frame that best represented the subject's natural/posed unstrained social smile was selected. The frame identified as the “held” smile by the examiner

was selected, which was 1 of the 15 consecutive frames in which the smile did not change. The selected posed smile frontal photograph of each subject was cropped using Adobe Photoshop 7.0. The selected posed smile frontal photograph of each subject was cropped using Adobe Photoshop 7.0 to create three types of images. The first image (face with the smile) was created by cropping the full face with posed smile in  $4 \times 6$ -inch proportions, standardizing each photo so that the head size would be the same in all photographs. The second image (face without the smile) was created by cropping the full face with posed smile into  $4 \times 6$ -inch proportions and standardizing each photo so that the head size would be the same in all photographs. From each of these cropped images, the smile region was hidden by a  $3 \times 5$ -inch brown box (same proportions as the third image), and the third image (smile" image) was a cropped image of only the teeth and lips [Figure 1]. These photographs were cropped in a standardized way using a  $3 \times 5$ -inch grid. The image remaining inside the

grid was used as the smile photo for the study. Finally, after editing, all the images were printed on  $4 \times 6$ -inch sheets of HPH Photo Paper using a HPH Photo smart printer. The  $3 \times 5$ -inch images of the lips and teeth were centered in landscape format on the  $4 \times 6$ -inch pieces of photo paper. The images of the full face, with and without the brown box covering the smile region and smiling photo, were printed in portrait format to fill the  $4 \times 6$ -inch photo paper. The photos were placed in a photo album. The questionnaire containing 11 questions was given to each of the evaluators along with the 3 photographs of the subjects to elicit the perception of each of the subjects. The evaluators were instructed to answer the questions from 1 to 8 looking at image 1 (face with smile), question 9 by looking at image 2 (face without the smile), and questions 10, 11 by looking at image 3 (smile only). The evaluators scored the subjects based on their level of attractiveness as (a) not attractive, (b) average, (c) attractive, (d) very attractive, and (e) I don't know [Figure 2].

DEPARTMENT OF ORTHODONTICS & DENTOFACIAL ORTHOPAEDICS	
PHOTOGRAPHIC ASSESSMENT OF FACIAL COMPONENTS IN FACIAL ESTHETICS	
<b>NAME OF SUBJECT:</b>	<b>NAME OF OBSERVER:</b>
<b>QUESTIONNAIRE:</b>	
1. How would you rate the overall harmony of the face?	
2. Give your rating on the symmetry of the face and its influence on facial attractiveness?	
3. What is your opinion about the proportion of eyes to the face?	
4. What do you feel about the proportion of the nose to the face?	
5. How would you rate the shape of the lips on smile?	
6. What is your opinion about the shape of the forehead and its role in facial aesthetics?	
7. What is your opinion about the role of chin in overall facial attractiveness?	
8. What is your comment about the cheekbone in overall facial attractiveness?	
9. What is your opinion about the smile and the role it plays on overall facial attractiveness?	
<b>RESPONSES:</b>	
a) Not attractive	
b) Average	
c) Attractive	
d) Very attractive	
e) I don't know	

Figure 1: questionnaire

## Statistical analysis

The Cronbach's alpha statistical analysis was performed to check the reliability of the questionnaire. A questionnaire is considered reliable when the values obtained after performing Cronbach's alpha statistical analysis are  $>0.7$ . Factor analysis was done to study individual facial features. The variables that are grouped into factor component 1 combine and contribute to overall facial attractiveness individually for each of the professionals. The regression analysis was performed to study the individual facial features. Intra-class correlation statistical analysis was performed to check the order of preferences for the three groups. Spearman rank correlation statistical analysis was performed to check the correlation between the three groups of observers.

## RESULTS

A total of 22 samples were included in this study (18 females and 4 males, age range: 18–24 years). These samples were evaluated by 3 orthodontists, 3 artists, and 3 photographers. The Cronbach's alpha statistical analysis was performed to check the reliability of the questionnaire. A questionnaire is considered reliable when the values obtained after performing Cronbach's alpha statistical analysis are  $>0.7$ . The value obtained for the questionnaire used in the present study was 0.831 which indicated its reliability.



Figure 2: photographic analysis

Factor analysis was used to study individual facial features. It is a useful tool for investigating variable relationships for complex concepts. It was used to identify possible underlying factors for overall facial attractiveness. In the orthodontist group, the 11 variables were grouped into 2 factors. Arrangement of teeth, gingiva, smile, symmetry of the face, shape of lips, proportion of eyes, and nose to face formed factor component 1. Factor analysis for the artist group was performed and the 11 variables were grouped into 4 factors. Smile, symmetry of face, shape of lips on smile, and arrangement of teeth formed the factor component 1. Exposure of gums formed the factor component 2. The proportion of eyes, shape of the forehead, proportion of the nose, and the role of chin formed the factor component 3. Cheekbone formed the factor component 4. Factor analysis for the photographer group was performed and the 11 variables were grouped into 3 components. Smile, arrangement of teeth, shape of lips on smile, proportion of nose, and exposure of gums formed the factor component 1. Role of cheekbone, role of chin, and proportion of eyes formed factor component 2. Symmetry of face and shape of forehead formed the factor component 3 [Table 1].

The regression analysis was performed to study the individual facial features. The orthodontist group showed that the facial feature most strongly associated with overall attractiveness was symmetry of face (0.413) followed by role of cheekbone (0.27) and shape of the lips (0.201). Exposure of gums (0.132) was the least considered facial feature. With respect to the artist group, regression analysis showed that the most important facial feature was symmetry of face (0.565), followed by shape of forehead (0.381) and the role of chin (0.282). The least associated feature was the role of smile (0.156). Among the photographer group, regression analysis showed that cheekbone (0.584) was the facial feature most strongly associated with overall attractiveness and the

Table 1: Factor analysis

Components	Orthodontist		Artist				Photographer		
	1	2	1	2	3	4	1	2	3
Smile	0.682		0.815				0.859		
Symmetry of the face	0.661		0.744				0.732		
Shape of lips on smile	0.563		0.715				0.699		
Arrangement of teeth	0.885		0.705				0.626		
Exposure of gums	0.830			0.744			0.459		0.447
Proportion of eyes	0.529				0.788			0.744	
Shape of the forehead		0.733			0.716			0.744	
Proportion of the nose	0.516	0.417			0.594	-0.420		0.674	
Role of chin		0.898			0.423	0.415			0.469
Cheekbone		0.858				0.867			0.898



least associated facial feature was the symmetry of face (0.371) [Table 2].

Intra-class correlation statistical analysis was performed to check the order of preferences for the three groups. A significant correlation was seen for symmetry of the face (0.652), shape of lips (0.624), cheekbone (0.543),

role of chin (0.522), and shape of forehead (0.513) for the orthodontist group. There was a significant correlation for symmetry of face (0.646), forehead (0.534), shape of lips on smile (0.502), and role of chin (0.501) for the artist group. The photographer group presented with a significant correlation for cheekbone (0.669), overall appearance (0.571), smile (0.535), and shape

**Table 2: Regression analysis**

Occupation	Model	Components	Unstandardized coefficients		Standardized coefficients ( $\beta$ )	T	Significance
			B	SE			
Photographer	1	Constant	0.941	0.333		2.826	0.006
		Cheekbone	0.584	0.121	0.515	4.804	0.000
	2	Constant	0.458	0.333		1.374	0.174
		Cheekbone	0.438	0.119	0.386	3.693	0.000
Artist	1	Symmetry of the face	0.371	0.103	0.378	3.616	0.001
		Constant	0.478	0.266		1.800	0.077
		Symmetry of the face	0.796	0.104	0.691	7.647	0.000
	2	Constant	-0.212	0.321		-0.661	0.511
		Symmetry of the face	0.717	0.100	0.622	7.208	0.000
		Shape of the forehead	0.360	0.107	0.290	3.358	0.001
	3	Constant	-0.785	0.345		-2.278	0.026
		Symmetry of the face	0.641	0.095	0.556	6.725	0.000
		Shape of the forehead	0.347	0.100	0.280	3.489	0.001
	4	Role of chin	0.303	0.091	0.268	3.317	0.002
		Constant	-1.004	0.354		-2.840	0.006
		Symmetry of the face	0.565	0.100	0.490	5.626	0.000
	5	Shape of the forehead	0.381	0.099	0.307	3.864	0.000
		Role of chin	0.282	0.090	0.250	3.151	0.003
		The smile	0.156	0.077	0.169	2.019	0.048
Orthodontist	1	Constant	0.762	0.235		3.239	0.002
		Symmetry of the face	0.740	0.085	0.738	8.740	0.000
	2	Constant	0.381	0.237		1.603	0.114
		Symmetry of the face	0.510	0.099	0.509	5.181	0.000
		Role of chin	0.337	0.090	0.368	3.746	0.000
	3	Constant	0.167	0.245		0.682	0.498
		Symmetry of the face	0.448	0.098	0.447	4.552	0.000
		Role of chin	0.319	0.087	0.348	3.664	0.001
	4	Exposure of gums	0.150	0.062	0.194	2.412	0.019
		Constant	0.112	0.241		0.467	0.642
		Symmetry of the face	0.419	0.097	0.418	4.319	0.000
	5	Role of chin	0.259	0.090	0.283	2.882	0.005
		Exposure of gums	0.127	0.062	0.165	2.056	0.044
		Shape of the lips on smile	0.141	0.070	0.177	2.011	0.049
	6	Constant	-0.093	0.251		-0.372	0.712
		Cheekbone	0.217	0.098	0.230	2.220	0.030
		Symmetry of the face	0.388	0.095	0.387	4.072	0.000
	7	Role of chin	0.105	0.111	0.115	0.945	0.348
		Exposure of gums	0.130	0.060	0.168	2.167	0.034
		Shape of the lips on smile	0.176	0.070	0.219	2.513	0.015
	8	Constant	-0.095	0.251		-0.378	0.707
		Cheekbone	0.274	0.076	0.291	3.592	0.001
		Symmetry of the face	0.413	0.091	0.412	4.532	0.000
	9	Exposure of gums	0.132	0.060	0.170	2.197	0.032
		Shape of the lips on smile	0.201	0.064	0.251	3.128	0.003

SE=Standard error

of lips on smile (0.519) [Table 3]. The ranking of the facial characteristics based on intra-class correlation is presented in Table 4.

Intra-class correlation statistical analysis was performed to check the agreeability between the three groups (orthodontists, artists, and photographers). The overall rating mean score between the groups showed the highest correlation between the orthodontist and artist groups (0.609), and the least correlation between the

artist and photographer groups (0.339) followed by the photographer and orthodontist groups (0.289). Intra-class correlation statistical analysis suggests agreeability about overall facial attractiveness significantly for the orthodontists and artists [Table 5] [Figure 3].

## DISCUSSION

The primary objective of this study was to establish the perception of facial esthetics by different professionals, namely orthodontists, artists, and photographers, which was intended to reveal the most influential facial characteristics involved in rating the overall attractiveness. The hair, face outline, eyes, and mouth are important for perceiving and remembering faces, and the upper part of the face is more useful for face recognition than the lower part. The facial photographs are effective in providing a valid way of analyzing facial attractiveness. The three-quarter view of the face results in better recognition than the frontal view, but it reveals more about the nose, and less about eyes and mouth, which are probably the more important features due to their role in communication. Frontal view has a disadvantage of flatness, but this is compensated by the fact that it reveals all the dimensions and relations

**Table 3: Intra-class correlation for individual groups**

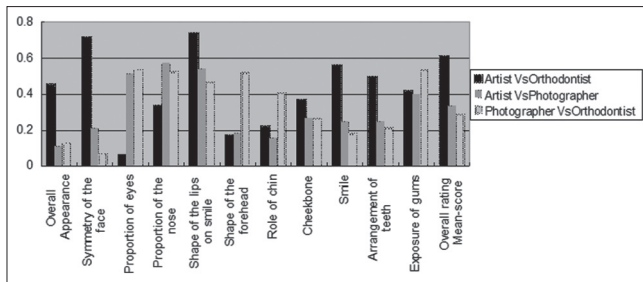
	Orthodontist	Artist	Photographer
Overall appearance	0.483	0.489	0.571
Symmetry of face	0.652	0.646	0.119
Proportion of eyes	0.43	0.317	0.194
Proportion of nose	0.434	0.339	0.366
Shape of lips on smile	0.624	0.502	0.519
Shape of forehead	0.513	0.534	0.119
Role of chin	0.522	0.501	0.079
Cheekbone	0.543	0.353	0.669
Smile	0.472	0.276	0.535
Arrangement of teeth	0.448	0.346	0.378
Exposure of gums	0.283	0.394	0.41
Overall rating mean score	0.523	0.619	0.551

**Table 4: Rank order of facial characteristics - intra-class correlation**

Orthodontist rank order (%)	Artist rank order (%)	Photographer rank order (%)
Symmetry of face (11)	Symmetry of face (12)	Cheekbone (14)
Shape of lips on smile (10)	Shape of forehead (10)	Overall appearance (12)
Overall appearance (9)	Overall appearance (9)	Shape of lips on smile (11)
Chin (9)	Chin (9)	Smile (11)
Cheekbone (9)	Shape of lips on smile (9)	Exposure of gums (9)
Shape of forehead (9)	Exposure of gums (8)	Proportion of eyes (8)
Smile (8)	Arrangement of teeth (7)	Arrangement of teeth (8)
Arrangement of teeth (8)	Cheekbone (7)	Proportion of nose (8)
Proportion of eyes (7)	Proportion of nose (6)	Shape of forehead (3)
Proportion of nose (7)	Proportion of eyes (6)	Chin (2)
Exposure of gums (5)	Smile (5)	Symmetry of face (2)

**Table 5: Intra-class correlation between groups**

	Artist versus orthodontist	Artist versus photographer	Photographer versus orthodontist
Overall appearance	0.452	0.114	0.133
Symmetry of the face	0.713	0.214	0.069
Proportion of eyes	0.062	0.516	0.538
Proportion of the nose	0.338	0.573	0.523
Shape of the lips on smile	0.739	0.544	0.467
Shape of the forehead	0.175	0.188	0.520
Role of chin	0.221	0.158	0.410
Cheekbone	0.368	0.271	0.265
Smile	0.558	0.251	0.182
Arrangement of teeth	0.498	0.251	0.214
Exposure of gums	0.417	0.403	0.533
Overall rating mean score	0.609	0.339	0.289



**Figure 3:** inter-class correlation between the three groups

of the internal features, such as the eyes and mouth are rated more attractive than profile views,<sup>[8]</sup> and therefore, the frontal view facial photographs were taken for the subjects.

Photographs of the subjects were taken in NHP which is a standardized and reproducible position, of the head in an upright posture, the eyes focused on a point in the distance at eye level, which implies that the visual axis is horizontal. A plumb line was used to orient the head of the subject to his or her NHP and this is called the registered NHP.<sup>[9]</sup> Video recordings were done instead of taking static images because capturing the subjects' smile images with conventional 35 mm photography has the drawback of difficulty in standardizing photographs due to differences in camera angles, distances to the patient, head positions, and discrepancies between intraoral and extraoral photographic techniques and its reproducibility is impossible. Standardized digital videography allows us to capture a patient's speech, oral and pharyngeal function, and smile at the same time.<sup>[10]</sup> Quantitative and qualitative analyses of lip-tooth-gingival relationships are easily accomplished with the aid of digital videography. Anterior tooth display is not the same during speech as in smiling, so by taking a video clip of both, we can evaluate all aspects of anterior tooth display. This helps the orthodontist to review the video clip with the patient, in order to familiarize the patient with his or her own smile. To relax the muscles, the subject was asked to say a short phrase "CHELSEA EATS CHEESECAKE ON THE CHESAPEAKE" and then asked to relax, gently touch the lips together, and then start smiling.

Digital video players allow slow-motion assessment of the dynamic smile. The digital video camera was mounted on tripod stand, and set at a fixed distance in the records room. The video camera captured a 10-s clip which was converted to 300 individual photographic frames and the frame that best represented the patient's social smile which was 1 of the 15 consecutive frames in which the smile did not change was selected.

Evaluations of the subjects in this study were done by nine panelists consisting of three orthodontists, three artists, and three photographers. Howells and Shaw<sup>[8]</sup> stated that for evaluation of facial esthetics, a panel of two persons can give acceptable reliability, but for improvement, they advocated a further increase in panel size. Kiekens *et al.*<sup>[11]</sup> stated that a panel of seven randomly selected laymen and/or orthodontists is sufficient to obtain reliable results in the esthetic evaluation of adolescent faces, using photographs and a visual analog scale.

To establish our main objective which was to elicit the perception of facial esthetics by different professionals, namely orthodontists, artists, and photographers, intra-class correlation between the groups was performed. The highest correlation was seen between the orthodontist and artist groups. The least correlation was found between the artist and photographer groups followed by the photographer and orthodontist groups.

The relationship between the artists and orthodontists began way back from infinitude. It was only as recently as the mid-1970s that true evidence in the form of mean data derived from growth studies became available for clinical use. Until then, improving an individual's facial appearance relied on the guidelines based on the experience of Renaissance artists during the 15<sup>th</sup> and 16<sup>th</sup> centuries. Roman architect Vitruvius's famous trisection is still recommended and used by orthodontists and orthognathic surgeons today, i.e. 2000 years later.<sup>[7]</sup> Many other Renaissance artists contributed to an overall scheme of proportions in human face that become the norms for use by artists, surgeons and orthodontist,<sup>[12]</sup> thereby substantiating the results of this study which shows the highest correlation between the orthodontist and artist groups.

On the other hand, photography has little to do with facial proportions unlike an artist or an orthodontist who largely depends on facial proportions to define facial esthetics. A photographer relies on other techniques such as ambient light, camera angle, and composition to bring the best out of his subject to create an esthetically looking photograph. This may be the reason for minimal correlation of the photographer with the other two groups.

The regression analysis, which is a statistical process for estimating the relationships among variables, was performed to study the individual facial features. The analysis predicted that the facial feature most strongly associated with overall attractiveness according to orthodontists was symmetry of face, followed by cheekbone and shape of lips and the least associated

facial feature being the exposure of gums. The four factors, i.e. symmetry of face, cheekbone, shape of lips, and exposure of gums, were able to justify overall attractiveness and the rest of the features were removed. The artists considered the symmetry of face, shape of forehead, and role of chin as the most important facial feature and the least associated feature was the smile. According to the photographers, cheekbone was the facial feature most strongly associated with overall attractiveness and the least associated facial feature was symmetry of face. This shows that overall facial attractiveness is more important than dental attractiveness.

Several studies have examined the effects of various dental features on facial attractiveness using full-face photographs. The findings of this study are similar to that of Shaw *et al.*,<sup>[13]</sup> who observed that the overall facial appearance of the patient may be more important than the smile region and that facial esthetics is not dependent on any isolated facial characteristic. The facial feature most strongly associated with overall attractiveness was cheeks and the features least associated were nose and teeth,<sup>[14]</sup> whereas in this study, it was seen that symmetry of the face, cheekbone, and shape of lips on smile were strongly associated with overall attractiveness and the least associated feature was exposure of gums and smile. The results of studies by Cunningham<sup>[15]</sup> and Meerdink *et al.*<sup>[16]</sup> agree on the importance of nose size and cheek width in the perception of facial attractiveness, which is also seen in this study.

To emphasize the role that smile plays on overall facial attractiveness, the factor analysis, which is a statistical method used to describe variability among observed correlated variables, was performed individually for each of the groups in which the variables were grouped into factor components. For the orthodontist group, arrangement of teeth, gingiva, smile, symmetry of the face, shape of lips, proportion of eyes, and nose to face formed factor component 1 which stated that these are the potential factors that contribute to overall attractiveness.

The artist group considered the factor component 1, i.e. smile, symmetry of face, and shape of the lips on smile and arrangement of teeth to combine and contribute to overall facial attractiveness. The photographers considered smile, arrangement of teeth, shape of lips while smiling, proportion of nose, and exposure of gums, i.e. the factors of component 1 to combine and contribute to overall facial attractiveness. This shows that smile does play an important role while rating overall attractiveness along with the other facial features. McNamara *et al.*<sup>[17]</sup> in their study found that

overall facial harmony and tooth alignment are the two most important characteristics for overall attractiveness. The two least important characteristics were skin and hair, which is not in favor of this study. However, they agreed on the importance of each facial characteristic when rating a smile, which is similar to this study.

In order to establish an order of preference for facial components, individually for the three groups of professionals, intra-class correlation statistical analysis for individual groups was done. Shape of lips on smile was preferred by all the three professional groups. The artists and orthodontists showed a similar preference for symmetry of face, chin, and forehead. The photographer and orthodontist groups preferred cheekbone. The photographer group preferred smile and overall appearance.

Orthodontists and artists have considered the symmetry of face as the most important feature for overall facial attractiveness. Facial symmetry and averageness have been studied previously, leading to conflicting results. They have been created by combining several individual faces into one composite face. Thornhill and Gangestad<sup>[18,19]</sup> argued that the degree of averageness and symmetry in faces is an essential factor in the perception of attractiveness which is similar to the findings of this study. Langlois and Roggman<sup>[20]</sup> and Grammer and Thornhill<sup>[21]</sup> have found that symmetrical faces are indeed perceived as more attractive which is similar to this study.

The highest correlation was seen between the orthodontist and artist groups followed by the photographer and artist groups and finally the photographer and orthodontist groups. This highest degree of agreeability between the orthodontist and artist groups was probably because of the similarity in the scheme of proportions that was used by the artists and orthodontists. The symmetry of the face, cheekbone, and shape of lips on smile were strongly associated with overall attractiveness and the least associated feature was exposure of gums and smile, which shows that the overall facial appearance of the patient may be more important than the smile region and that facial esthetics is not dependent on any isolated facial characteristic.

## CONCLUSION

The view about overall facial attractiveness significantly correlates for orthodontists and artists. The perception by the three professionals confirms that facial esthetics is not dependent on any isolated facial characteristic and the overall facial attractiveness is more important than dental attractiveness.



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## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Giddon DB. Orthodontic applications of psychological and perceptual studies of facial aesthetics. *Semin Orthod* 1995;1:82-93.
- Tufekci E, Jahangiri A, Lindauer SJ. Perception of profile among laypeople, dental students and orthodontic patients. *Angle Orthod* 2008;78:983-7.
- Diamond O. Facial esthetics and orthodontics. *J Esth Dent* 1996;8:136-43.
- Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 1. Evolution of a concept of dynamic records for smile capture. *Am J Orthod Dentofacial Orthop* 2003;124:4-12.
- Wuerpel EH. My friend, Edward Hartley Angle. *Dent Cosmos* 1931;71:908-21.
- Faure JC, Rieff C, Mai JC. The influence of different facial components in facial esthetics. *Eur J Orthod* 2002;24:1-7.
- Peerlings RH, Kuijpers-Jagtman AM, Hoeksma JB. A photographic scale to measure facial aesthetics. *Eur J Orthod* 1995;17:101-9.
- Howells DJ, Shaw WC. The validity and reliability of ratings of dental and facial attractiveness for epidemiological use. *Am J Orthod* 1985;88:402-8.
- Jiang J, Xu T, Lin J. The relationship between estimated and registered natural head position. *Angle Orthod* 2007;77:1019-24.
- Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. *J Clin Orthod* 2002;36:221-36.
- Kiekens RM, Matha JC, Vant Hof MA, Kuijpers Jagtman AM. Objective measures as indicators for facial aesthetics in white adolescents. *Angle Orthod* 2006;76:551-6.
- Kandel ER, Schwartz JH, Jessell TM. *Principles of Neural Science*. 4<sup>th</sup> ed. New York, NY: McGraw-Hill; 2000.
- Shaw WC. The influence of children's dentofacial appearance on their social attractiveness as judged by peers and lay adults. *Am J Orthod* 1981;79:399.
- Tatarunaite E, Playle R, Hood K, Shaw W, Richmond S. Facial attractiveness: A longitudinal study. *Am J Orthod Dentofacial Orthop* 2005;127:676-82.
- Cunningham MR. Measuring the physical in physical attractiveness: Quasiexperiments on the sociobiology of female facial beauty. *J Pers Soc Psychol* 1986;50:925-35.
- Meerdink J, Garbin CP, Leger DW. Cross-genderperceptions of facial attributes and their relation to attractiveness: Do we see them differently than they see us? *Percept Psychophys* 1990;448:227-33.
- Havens DC, McNamara JA Jr., Sigler LM, Baccetti T. The role of the posed smile in overall facial esthetics. *Angle Orthod* 2010;80:322-8.
- Thornhill R, Gangestad SW. Human facial beauty: Averageness, symmetry and parasite resistance. *Hum Nat* 1993;4:237-69.
- Gangestad SW, Thornhill R, Yeo RA. Facial attractiveness, developmental stability and fluctuating asymmetry. *Ethol Sociobiol* 1994;15:73-85.
- Langlois JH, Roggman LA. Attractive faces are only average. *Psychol Sci* 1990;1:115-21.
- Grammer K, Thornhill R. Human facial attractiveness and sexual selection: The role of symmetry and averageness. *J Comp Psychol* 1994;108:233-42.