Original Contributions

Smile prevails over other facial components of male facial esthetics

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ABSTRACT

Background. The aim of this study was to assess whether scores assigned to the eyes, nose, mouth, and chin regions work as predictors of full smiling face scores.

Methods. In this cross-sectional study, the authors used the facial photographs of 86 smiling men. Photographs yielded 5 components: 1 of the face itself and 4 subcomponents (eyes, nose, mouth, and chin region). Raters assigned the photographs beauty scores that the authors measured morphometrically. The authors analyzed the predictive ability of the subcomponents against that of the full face.

Results. The subcomponents were statistically significant predictors of facial beauty (mouth: $r^2 = 0.38$, $P < .0001$; eyes: $r^2 = 0.14$, $P < .0001$; chin region: $r^2 = 0.09$, $P < .0001$; nose: $r^2 = 0.02$, $P = .05$). The more beautiful people had several statistically significant characteristics, such as narrower faces.

Conclusions. Facial subcomponents are predictive factors of the male smiling face and contribute in the following descending order of importance: mouth, eyes, chin region, and nose.

Practical Implications. The results suggest that for many people improvement in smile esthetics also likely will exert a more positive effect on facial beauty than will other procedures (for example, rhinoplasty).

Key Words. Face; facial esthetics; facial beauty; beauty; smile esthetics; smiles; predictors.

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Despite the fact that beauty is an important element in social life and that the face is the most important factor of a person's beauty,[1-3] precisely how facial attractiveness develops and is perceived among people is still the subject of much controversy.[4-7] Some people tend to believe that beauty is in the eye of the beholder,[1,5] which suggests that physical appearance in and of itself may not explain a person's beauty satisfactorily. Therefore, one may assume that the extent to which a person bonds affectively to another plays a key role in the perception of facial beauty, thus explaining why certain faces look beautiful to some and not to others.[1] Some have suggested that the perception of beauty is assimilated from early childhood through cultural stereotypes, for example, via family images and remarks, media, and film.[8]

However, there is a growing body of evidence showing that the perception of beauty is innate in its origin,[6,8] and there is even agreement as to what (or who) supersedes what (or whom) in comparing sexes, ethnic groups, and ages.[1,3,5,9,10] Even babies 2 or 3 months old were able to judge faces previously analyzed by adults as beautiful or unsightly, with a high level of agreement,[11,12] which suggests that the perception of facial beauty has an important biological foundation.[8,13-15]

Understanding the elements associated with higher facial beauty scores plays an important part in a wide range of health care areas, because there is an obvious increase in demand for esthetic treatments. Put simply, this demand occurs in an attempt not only to make the face—and the smile—increasingly beautiful but also to repair or rebuild these structures when they are impaired by disease or deformity.

In this study, thus, we aimed to evaluate the esthetics of young male adults' smiling faces and determine the predictive ability in assigning beauty scores to the eye, nose, mouth, and chin regions by applying an overall facial beauty score. The specific aims were to evaluate among these subcomponents which morphologic traits were associated more intimately with higher beauty scores.

METHODS

The Ethics Committee of the University of Brasilia, Brasilia, Distrito Federal, Brazil, approved this study (no. CEP-FM 004/2006). The participants were 86 white men aged 19 to 30 years, all nondental undergraduate students enrolled at universities in Brasilia, Distrito Federal, Brazil.

Exclusion criteria were presence of clinically identifiable Class II or Class III dentofacial deformities; history of cleft lip or palate; and presence of fixed orthodontic appliances, beard, mustache, or relevant skin blemishes, such as large scars or lesions. We did not photograph anyone wearing glasses. Each participant received and signed an informed consent form providing their age in years.

We covered the participants' hair with standardized white caps and placed their heads in a natural rest position on a cephalostat (Figure 1A). We told the participants to smile voluntarily while we photographed their smiling faces orthogonally at a standardized frontal view by using a macro 50-millimeter lens (Canon EF 50mm F, Canon) and a digital single-lens reflex camera (Canon EOS 300D, Canon) placed over a tripod at a 1-meter distance. We attached a calibration sphere with a diameter of 2.0 centimeters to the cephalostat over each person's forehead (Figure 1A).

We adjusted the pictures by using a computer program (Photo-Paint X7, Corel). We converted the images into 16-bit gray scale and then cropped them to obtain full smiling face photographs (Figure 1B), thereby excluding confounding areas. Thereafter, we once again cut out the matrix photographs so that each could generate 4 photographs of facial subcomponents: eyes, nose, mouth, and chin region (Figures 1C-1F). In the final analysis, we used all photographs, except for the matrices with no cutouts. (Figures 1B-1F).

The size of the cutouts was the same for all participants. We selected those who had the largest dimensions for each given subcomponent of the face for that particular subcomponent.

Thus, the cutouts to obtain the photographs of the smiles used as the benchmark the biggest mouth among all the people of the sample. In this person, the upper limit constituted the region immediately below the columella region, the lateral limits consisted of the oral comissures, and the lower limit consisted of the lower edge of the lower lip. On the sides and bottom portions, we included a slight margin of the face to frame the area. We applied the dimensions of this rectangle to all faces, even if this caused the face to be displayed only slightly around the area of interest. We used the same methodology for the cutouts of the nose and chin so that in the resulting photographs of the noses the areas of the eyes were covered by a mask to avoid affecting the analysis in the nasal region.

We measured linear morphometric variables on the matrix photographs by using a computer program (Image-Pro, Media Cybernetics) (Figure 2). We used the 2-cm sphere to calibrate the program during the measurements (Figure 1A). We calculated 4 other variables by using the data from Figure 2: the ratio of the interzygomatic distance to the cheek width, the ratio of the middle one-third of the face to the lower one-third of the face, the ratio of the face height to the interzygomatic distance, and the ratio of the intercanthal distance to the eye width. We obtained 2 other variables by means of visual inspection: the round, square, or triangular shape of the lower edge of the chin and the presence or absence of a double chin.

We invited a convenience sample of 15 women aged 20 to 60 years to rate the photographs. They were laypeople and senior students in economics ($n = 5$), business administration ($n = 5$), and biology ($n = 5$) at the University of Brasilia. All raters signed an informed consent form.

We developed a Web site specifically for the evaluation of the photographs. Each rater received an e-mail with a password to access the Web site, as well as instructions on how to use the Web site tools and rate the photographs. Each photograph was shown randomly on the computer screen, along with a visual categorical scale with numbers ranging from 0 (not handsome) to 10 (very handsome). Each rater clicked on the number that corresponded to her perception of the beauty of the face or subcomponent. We also asked the raters to estimate the person's age in years when exposed to the facial photograph.

We analyzed the data statistically by using software (SAS Version 8.1, SAS Institute). We obtained descriptive statistics from the variables. We used a stepwise multiple regression analysis ($\alpha = .05$) to test the effect of the scores given to the eyes, nose, mouth, and chin region on the beauty of the face as a whole. The premises of normality, linearity, and homoscedasticity of residuals were not violated. We screened univariate and multivariate outliers.

ABBREVIATION KEY

NA: Not applicable.

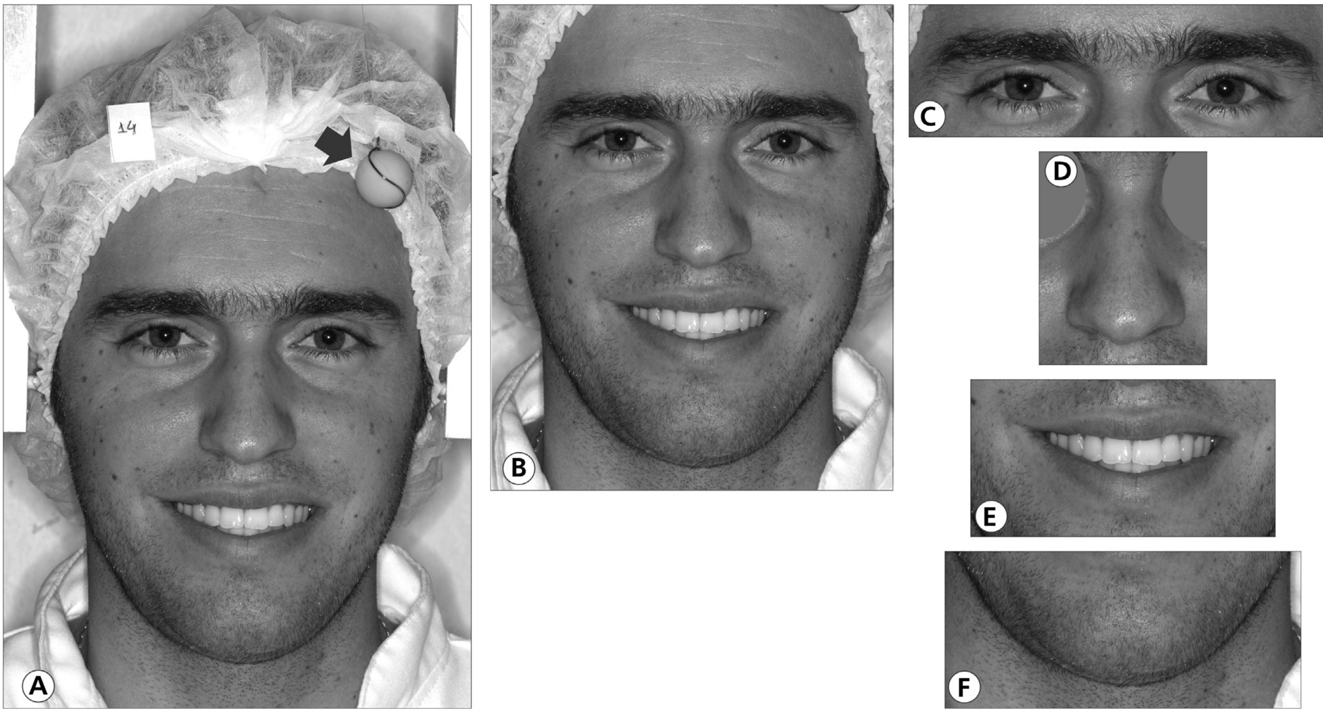

Figure 1. **A.** Initial photograph (arrow indicates calibration sphere). **B.** Face photograph cutout analyzed by the raters. **C.** Eye cutout. **D.** Nose cutout with eye overlay. **E.** Smile cutout. **F.** Chin region cutout.

Subsequently, we studied significant subcomponents in predicting facial beauty, with the exception of the smiling mouth, which we evaluated in a separate study. To this end, we ranked the scores assigned to the smiling face and the subcomponents and divided them into 3 groups: the most handsome group (n = 33), the least handsome group (n = 33), and the midterm group (those between the 2 extremes; n = 20). We excluded the latter group from the sample and studied only the extremes. The aim of this approach was to emphasize the features that affected the beauty of the face or its subcomponents to a greater or lesser degree.

The allocation to 1 of the 2 groups was the dependent variable, and the morphometric variables presented in Figure 2 and Table 1 were the independent variables. We tested the hypothesis of no difference in the morphometric variables between the most handsome group and the least handsome group with a series of t and χ^2 tests. Analysis of variance was used to assess differences among shapes of the lower chin edge (square, triangular, round), and characteristics of the double chin (absence, little, much). Newman-Keuls tests were used for multiple comparison when adequate. We set statistical significance at 5%.

We calculated the measurement error by using the Dahlberg equation:

$$\sqrt{\frac{\sum d^2}{2n}},$$

where d is the difference between 2 measurements made by the same evaluator at 2-week intervals between measurements, and n is the sample size. We asked raters to reevaluate 30% of the sample. This subsample size was arbitrarily established since the time-consuming reassessment of the whole sample by volunteers would probably not be feasible. Table 1 shows the error found. We calculated Cohen κ coefficients for the categorical chin variables (Table 2).

RESULTS

The multiple regression model was significant for the beauty score of smiling faces ($F_{4,83} = 44.26$; $P <$ .0001). The significant variables were mouth ($r^2 = 0.38$), eyes ($r^2 = 0.14$), chin region ($r^2 = 0.09$), and nose ($r^2 = 0.02$) (Table 3). The mean (standard deviation) estimated age of the people photographed was 25.9 (20.5, minimum; 36.5, maximum) years, and age was not significant as a beauty predictor for

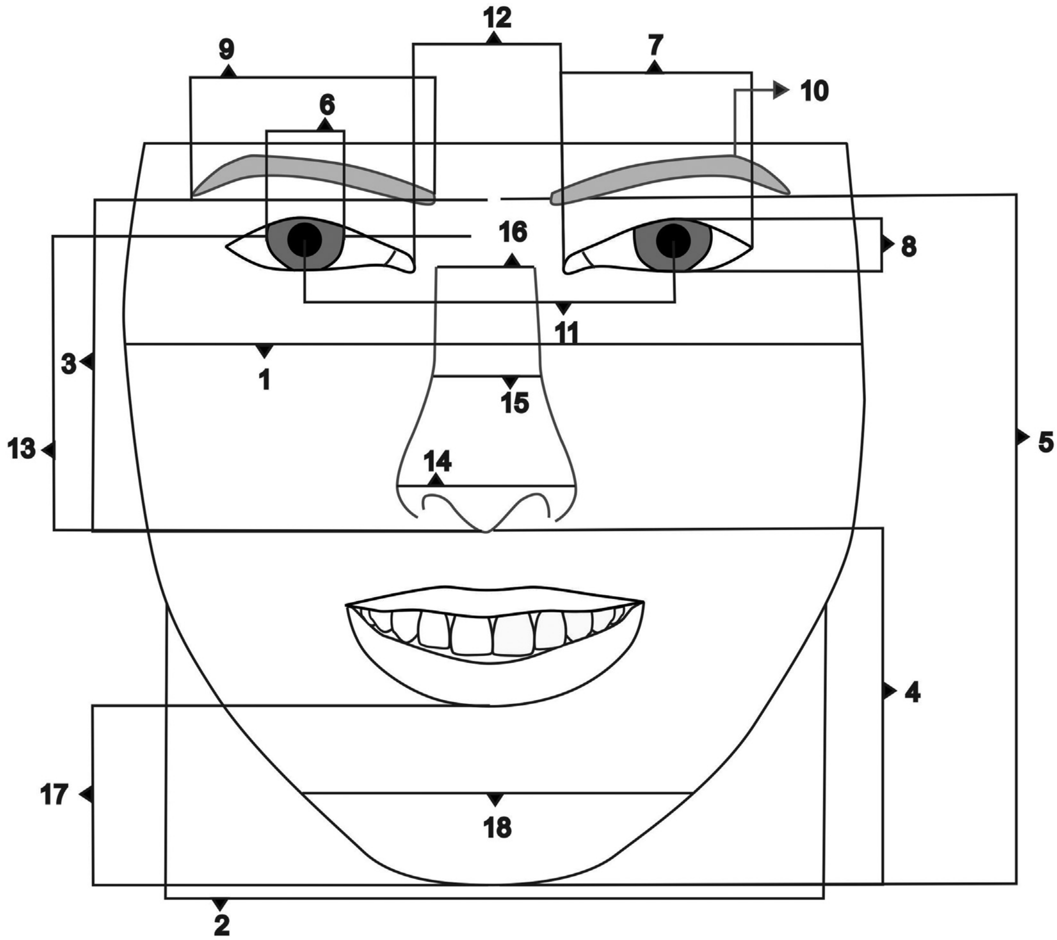

Figure 2. Morphometric variables measured in centimeters on the faces of the participants in the sample. For the face, 1: interzygomatic distance (greater width of the face at the level of the zygomatic bones); 2: cheek width (face width at the level of the corners of the mouth); 3: middle one-third of the face (distance from glabella point to subnasal point); 4: lower one-third of the face (distance from subnasal point to base of chin); and 5: indicates face height (sum of the middle on-third of the face and the lower one-third of the face). For the eyes, 6: iris size (mean diameters of the right and left irises); 7: eye width (mean widths of the right and left eyes); 8: interpalpebral distance (mean right and left interpalpebral distances measured at the center of the pupil); 9: eyebrow length (mean lengths of the right and left eyebrows); 10: highest eyebrow point (considering the eyebrow length where its highest point lies, as a percentage, as measured from its medial corner; mean right and left eyebrow values); 11: interpupillary distance (distance between the centers of the pupils); 12: intercanthal distance (distance between the medial corners of the eyes). For the nose, 13: nose height (distance from nasion to subnasal point); 14: alar base width (distance between the most convex points of the nose wings); 15: dorsum width (nose width at one-half its height); 16: root width (nose width at the height of the medial epicanthal folds of the eyes). For the chin region, 17: chin region height (distance from the lower edge of the lower lip to the base of the chin), 18: chin region width (face width at one-half the height of the chin region).

smiling faces. Tables 1 and 2 show the results of the *t* test and χ^2 test for the morphometric variables. The most handsome people had narrower faces, with smaller interzygomatic distance and cheek width, larger interpalpebral distances, longer interpupillary distances, longer eyebrows, a narrower alar base, a narrower chin region, a straight lower edge of the chin, and no double chin.

DISCUSSION

Several factors contribute to a lack of clarity in the literature regarding facial beauty. Investigators in many studies do not seem to make it clear enough whether the actual target of their study is facial beauty or facial attractiveness.[16-23] In this study, we focused on the beauty of the face because there is a difference between attractiveness and beauty.[18] Although it is true that attractiveness can fascinate, not all that attracts is necessarily beautiful.[18]

Another factor, also of a methodological nature, that seems to contribute to this lack of clarity is the way in which investigators present facial subcomponents to raters. In some studies,[5,24] the evaluator analyzed a given facial subcomponent by means of a full face photograph rather than

Table 1. Descriptive statistics, measurement error, and *t* test results for the variables of the face.

MORPHOMETRIC VARIABLE	MEASUREMENT ERROR	MOST HANDSOME, CENTIMETERS	LEAST HANDSOME, CM	*P* VALUE
		Mean (SD)*	Mean (SD)	
Full Face				
Interzygomatic distance	0.0645	12.33 (0.47)	12.67 (0.59)	.02‡
Cheek width	0.0763	11.34 (0.53)	11.70 (0.65)	.02‡
Ratio of interzygomatic distance to cheek width‡	—§	92.03 (3.63)	93.05 (3.16)	.24
Middle one-third of the face	0.0589	5.45 (0.32)	5.32 (0.42)	.17
Lower one-third of the face	0.0620	6.61 (0.43)	6.78 (0.59)	.19
Ratio of middle one-third of the face to lower one-third of the face#	—	1.15 (0.57)	1.42 (0.69)	.10
Face height	0.0456	12.06 (0.50)	12.18 (0.68)	.44
Ratio of face height to interzygomatic distance**	—	0.97 (0.03)	0.95 (0.04)	.02‡
Eyes				
Iris size	0.0485	1.06 (0.04)	1.04 (0.03)	.15
Eye width	0.0423	2.53 (0.17)	2.47 (0.18)	.17
Interpalpebral distance	0.0356	0.72 (0.09)	0.62 (0.12)	.001†
Eyebrow length	0.0456	3.98 (0.34)	3.77 (0.37)	.03†
Highest point on the eyebrow	0.0458	73.66 (3.73)	73.09 (3.94)	.56
Interpupillary distance	0.0512	5.80 (0.25)	5.64 (0.31)	.03†
Intercanthal distance	0.0462	3.00 (0.24)	2.88 (0.24)	.06
Ratio of intercanthal distance to eye width††	0.0395	1.16 (0.09)	1.14 (0.10)	.42
Nose				
Nose height	0.0564	4.57 (0.29)	4.55 (0.34)	.76
Alar base width	0.0563	3.77 (0.22)	3.95 (0.21)	.001†
Dorsum width	0.0498	1.64 (0.19)	1.69 (0.23)	.32
Root width	0.0456	1.33 (0.14)	1.39 (0.14)	.18
Chin Region				
Height	0.0654	3.21 (0.27)	3.19 (0.44)	.88
Width	0.0598	6.95 (0.54)	7.68 (1.43)	.01†

* Standard deviation. † Statistically significant at 5% level. ‡ Percentage relationship between interzygomatic distance and cheek width. § Error not calculated for ratios. # Division of the lower one-third of the face by the middle one-third of the face. ** Division of face height by interzygomatic distance. †† Division of intercanthal distance by eye width.

analyzing the facial subcomponents separately. This possibly restrained the analysis of the facial subcomponent in question. For example, an unsightly nose might, within the context of a face that displays a gorgeous smile, be perceived as more beautiful than it really is and, therefore, may not play its actual role in the esthetic score for that particular face. In this study, we attempted to reduce this methodological weakness by using the subcomponents of the face and analyzing them 1 by 1, separately and randomly, thereby eliminating possible interactions among the parts of the face.

In our results, the 4 facial subcomponents together could account for a significant portion of the data variance ($r^2 = 0.63$; $P < .05$) for facial beauty. The estimated age of the people photographed for the study was the only factor unable to explain the beauty score assigned to the face. Thus, our results do not validate the commonsense belief that beautiful people often are seen as younger than are uglier people, as other authors have found.[5,25] However, this study sample consisted of a group of relatively young people, which may have affected the results.

Among the 4 subcomponents, the nose was the factor of least effect, with an r^2 of only 0.02 ($P =$ .05) (Table 1). Other investigators also have cited the nose as the subcomponent least responsible

Table 2. Mean beauty scores, Cohen κ coefficients, and analysis of variance results for the variables in the chin region.

VARIABLE	COHEN κ	FEATURE	NO. OF INDIVIDUALS	MEAN (STANDARD DEVIATION)*	*P* VALUE
Shape of the Lower Chin Edge†	0.72	Square	25	5.74 (1.33)[a]	.01‡
		Triangular	19	5.64 (1.10)[ab]	
		Round	42	5.07 (1.07)[b]	
Double Chin§	0.81	Absence	59	5.81 (1.03)[a]	< .0001‡
		Little	14	4.85 (0.88)[b]	
		Much	13	4.09 (0.98)[b]	

* Letters represent the results of the Newman-Keuls tests after two analysis of variance. Groups with the same letters do not differ between each other. † Classification of the lower chin edge according to shape: round, square, or triangular. ‡ Statistically significant at 5% level. § Classification of chin region according to absence of double chin, presence of little double chin, or presence of much double chin.

Table 3. Variables included in the multiple regression model in which the beauty of the smiling face was the dependent variable.

MODEL NO.	VARIABLE	INTERCEPT	95% CONFIDENCE INTERVAL	r^2	*P* VALUE
1	Constant	1.614	1.603 to 1.626	0.542	< .0001
	Smile	0.660	0.658 to 0.662	NA*	< .0001
2	Constant	0.409	0.395 to 0.424	0.601	< .0001
	Smile	0.572	0.570 to 0.574	NA	< .0001
	Eyes	0.277	0.275 to 0.279	NA	< .0001
3	Constant	0.007	−0.008 to 0.022	0.626	.377
	Smile	0.522	0.520 to 0.524	NA	< .0001
	Eyes	0.237	0.235 to 0.240	NA	< .0001
	Chin	0.171	0.169 to 0.173	NA	< .0001
4	Constant	−0.133	−0.148 to −0.118	0.634	< .0001
	Smile	0.515	0.513 to 0.517	NA	< .0001
	Eyes	0.209	0.207 to 0.212	NA	< .0001
	Chin	0.151	0.149 to 0.153	NA	< .0001
	Nose	0.106	0.103 to 0.108	NA	< .0001

* NA: Not applicable.

for greater facial attractiveness.[5,26] Arguably, the nose exerts less effect on the beauty of the face as a whole because it is a structure less influenced by the mimic muscles. Thus, because it expresses less emotion, it also attracts the viewer's attention less. Given that the nose is the most prominent anatomic structure of the face, one might assume that its assessment in profile pictures might be more influential when assigning facial beauty scores.

Concerning the morphometric variables measured on the nose, results from this study—as well as from others[10,16-29]—seem to agree that most beautiful white people have narrow noses. Our results showed that increasing the alar base negatively affects the esthetics of the nose, whereas a more tapered shape looks better.

The chin region ranked third in the regression model ($r^2 = 0.09$) used to score facial beauty (Table 2). Narrower chin regions were associated more significantly with more beautiful faces. Unlike the width, the height of the chin region was not a significant factor. In another study,[27] wider chins were related to more attractive faces. Nevertheless, what these authors measured was the height of the chin, so it would be more appropriate to determine that longer chins—not wider chins—are associated with more attractive faces. These results suggest that clinicians should prescribe vertical chin reduction genioplasty with utmost caution to avoid overprescribing the treatment. Given that the chin is not well defined enough to allow it to be classified distinctively and consistently, we asked raters to classify only the lower chin contour, and they rated a straighter chin as more beautiful.

The fact that the presence of a double chin negatively affected the beauty of the face raises an interesting question. People with a double chin tend to exhibit a higher body mass index, and the amount of adipose tissue may be reflected in increased width of the cheeks and interzygomatic distance. An interesting factor to be considered in future studies is body mass index.

The second facial beauty regression ranking position belonged to the eyes ($r^2 = 0.14$; $P < .0001$) (Table 3). Among the morphometric variables measured in the eyes, the width showed no relevance when studying the faces. However, eyes with a higher interpalpebral distance were related significantly to the most beautiful faces. This finding may be explained by the dwindling of the eye contact area noticeable when 2 people exchange a smile because smiling causes a transient decrease in the interpalpebral distance. When the eyes of a person appear more open, the person tends to be judged more beautiful.

Eyebrow height had no significant bearing on the faces. Expression features such as high eyebrows seem to be more related to female than male beauty.[27] However, although height was not relevant, longer eyebrows were related significantly to the most beautiful male faces.

Regarding the other measurements on the faces of the people photographed (Table 1), our results revealed that narrower faces with smaller interzygomatic distances and narrower cheeks were the most beautiful, contrary to what was reported in another study in which broad, short faces seemed more attractive.[28] Unlike evidence found hitherto,[27] the ratio of the interzygomatic distance to the cheek width was not significant in this analysis.

The ratio of the middle one-third of the face to the lower one-third of the face and the ratio of the intercanthal distance to the eye width were not associated with beauty. This finding suggests that facial ratios such as equality between the facial one-thirds, as well as a 1:1 ratio between eye width and intercanthal distance, are not as important as previously believed.[3,7,17,24,30,31]

Among all subcomponents, the smiling mouth was the factor with the highest effect on the facial beauty score ($r^2 = 0.38$) (Table 3). As mentioned earlier, the mouth and eyes played the same degree of importance for the attractiveness of male faces.[26]

The fact that the smiling mouth plays a key part in facial beauty may be ascribed to the fact that the mouth is considered the communication center of the face,[32] and the smile wields the greatest power when it comes to conveying facial expressions[33] such as joy, friendliness, confidence, sociability, and positive emotions.[34] Smiling people usually are considered more beautiful than when they are at rest (not smiling)[5,35,36] suggesting that the smiling mouth plays an important role in facial beauty. Thus, in examining a smiling face, the smile seems to be the facial component that draws the viewer's attention the most. Part 2 of this study involves both linear and area measurements, as well as measurements of smile components, thereby demonstrating that morphologic characteristics are associated more closely with higher scores assigned to the beauty of the smile.

Ultimately, facial beauty seems to result from a composition of the subcomponents of the face whereby these subcomponents vary according to an order of importance vis-à-vis their ability to please. Thus, our results suggest that it seems to be less compromising for the esthetics of the male smiling face to have an ugly nose than an ugly mouth. That finding may explain why sometimes we see people with an ugly nose who nevertheless still are considered beautiful, whereas the opposite is less likely to happen. We conducted this study by using healthy faces without visible deformations, which means that the facial subcomponents were within the range of healthy anatomic variability, although not necessarily within the ideal esthetic proportions. Therefore, an ugly nose does not mean a deformed nose, in which case it might exert a much greater effect on the beauty of the face.

A limitation of our study is that we analyzed only male undergraduate students' photographs. This limitation mitigates the external validity of our results because we photographed only young male adults, and we do not know how the facial subcomponents would predict facial beauty in other age strata and on female faces. These are relevant topics for future research.

Our data disclosed not just the obvious importance of dentistry functionally but also esthetically. The data also can guide patients in making important esthetic treatment decisions. For example, many high-cost cosmetic surgery procedures are performed on the nose. Possibly, in many cases, performing a dental treatment instead of an esthetic surgical procedure might produce a much more positive effect on the esthetics of the patient through less invasive procedures and less risk to the patient's health.[37-39] However, further studies are warranted in this area specifically to enable better informed evidenced-based treatment decisions.

CONCLUSIONS

Within the limitations of this study, we concluded that facial subcomponents were predictive factors in the male smiling face and contributed in the following descending order of importance: mouth ($r^2 = 0.38$), eyes ($r^2 = 0.14$), chin region ($r^2 = 0.09$), and nose ($r^2 = 0.02$). The most beautiful people had narrower faces, with smaller interzygomatic distances and cheek widths, larger interpalpebral distances, longer interpupillary distances, longer eyebrows, narrower alar bases, narrower chin regions, a straight lower chin edge, and no double chin. ■

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