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Morphological Quantitative Criteria and Aesthetic Evaluation of Eight Female Han Face Types

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Abstract
Background Human facial aesthetics relies on the classification of facial features and standards of attractiveness. However, there are no widely accepted quantitative criteria for facial attractiveness, particularly for Chinese Han faces. Establishing quantitative standards of attractiveness for facial landmarks within facial types is important for planning outcomes in cosmetic plastic surgery. The aim of this study was to determine quantitatively the criteria for attractiveness of eight female Chinese Han facial types.
Methods A photographic database of young Chinese Han women's faces was created. Photographed faces (450) were classified based on eight established types and scored for attractiveness. Measurements taken at seven standard facial landmarks and their relative proportions were analyzed for correlations to attractiveness scores. Attractive faces of each type were averaged via an image-morphing algorithm to generate synthetic facial types. Results were compared with the neoclassical ideal and data for Caucasians.
Results Morphological proportions corresponding to the highest attractiveness scores for Chinese Han women differed from the neoclassical ideal. In our population of young, normal, healthy Han women, high attractiveness ratings were given to those with greater temporal width and pogonion–gonion distance, and smaller bizygomatic and bigonial widths. As attractiveness scores increased, the ratio of the temporal to bizygomatic widths increased, and the ratio of the distance between the pogonion and gonion to the bizygomatic width also increased slightly. Among the facial types, the oval and inverted triangular were the most attractive.
Conclusion The neoclassical ideal of attractiveness does not apply to Han faces. However, the proportion of faces considered attractive in this population was similar to that of Caucasian populations.
Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Face classification · Facial aesthetics · Attractiveness · Face modeling · Aesthetic surgery · Chinese face

Introduction

The foundation of facial aesthetics is the classification of facial types and features and popularly accepted standards of attractiveness. Quantitatively determining the ideal proportions of facial landmarks within generalized established facial types is important for the planning of successful cosmetic surgery. The shape of the head and facial features differs by race and gender, and even within the same race, factors such as geographic location may result in differences in average measurements [1–3]. Therefore, no widely accepted quantitative criteria exist for facial attractiveness, particularly for Chinese Han faces.

In the present study, we divided the photographs of faces of young Chinese Han women into eight established

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generalized facial types [4] and scored them according to Chinese aesthetic standards. We then quantitatively characterized the facial landmarks within these facial types. We were thus able to set morphological guidelines for contour remodeling.

Materials and Methods

Selecting Subjects

To create a photographic database of women's faces, we screened social women's groups, nurses, theater actors, college students, and factory workers in July 2009. All of the 522 subjects were female, of Chinese Han ethnicity, 18–25 years old, and developmentally normal with no facial skull deformities or history of facial trauma or surgery. The study conformed to the Declaration of Helsinki and was approved by the hospital's Institutional Review Board. All the women provided written informed consent to participate and to have an image of their face used in the research.

Method of Measurement

All photographs were taken by one assistant, in the laboratory, under identical conditions, and the same facial views. Facial measurements of each photograph were done separately by three team members to obtain mean values.

Implementation

Photographs were taken using a single Nikon D50 SLR camera (Nikon, Tokyo, Japan) on a fixed tripod with a backdrop of blue cloth. Lighting consisted of one key light, a fill light, and a background light. Facial landmarks were measured using a vernier caliper with an accuracy of 0.2 mm, and a bend angle gauge and ruler, both accurate to 1 mm.

Measuring Process and Specific Operations

To obtain a photograph, each subject was seated with the Frankfurt (auriculo-orbital) plane horizontal. Photographs were taken of the frontal aspect, facing 45° to the right, 45° to the left, 90° to the right, and 90° to the left, with the outer margins of the head and sternoclavicular joint inclusive.

Data measurements were performed as follows. All subjects were instructed to relax, remain seated, with the Frankfurt plane horizontal. The same laboratory assistant marked the measurement points and obtained measurement data from each subject.

Points of Measurement

Based on published anthropometric criteria [5], measurements were taken at seven standard classical facial landmarks: three horizontal (temporal and bizygomatic widths and bigonial breadth), three vertical (heights of the upper, middle, and lower face), and one oblique (the distance between the pogonion and gonion; Table 1; Fig. 1). We then calculated the relative proportions of the different facial landmarks and their correlation with aesthetic value scores. From the horizontal landmarks, we measured the temporal width (the distance between temporal points), the bizygomatic width (the breadth of the face from the widest point of one zygomatic arch to the corresponding point contralateral), and the bigonial breadth (distance between the gonia). In the vertical view, we measured the upper, middle, and lower face heights. The distance between the pogonion and gonion was measured from the oblique view.

Facial Classification and Attractiveness Score

A screening group of seven experts in aesthetic or cosmetic plastic surgery classified each face according to standard Chinese clinical aesthetic plastic surgery practice [4]. Each face that was selected received five or more votes for being one of eight facial types (round, oval, square, rectangular, diamond, triangular, inverted triangular, or trapezoidal) (Fig. 2). In all, 450 faces were selected. Each face was then scored according to degree of attractiveness on a 5-point Likert scale (1 = unattractive, 2 = relatively unattractive, 3 = average, 4 = attractive, 5 = very attractive). Some known celebrities, singers, and actresses of Chinese origin were also chosen for facial classification.

Table 1 Measurement landmarks and definitions

	Measurements items	Definitions
Horizontal landmarks	Temporal width	Width of the temporal points
	Bizygomatic width	Breadth of the face from the widest part of one zygomatic arch to the widest part of the other
	Bigonial breadth	Distance between the gonia
Vertical landmarks	Upper face height	Distance between trichion and glabella
	Middle face height	Distance between glabella and nasospinale
	Lower face height	Distance between nasospinale and gnathion
Oblique landmarks	Distance between pogonion and gonion	Average of left and right side data

Fig. 1 Measurements were made of seven classic facial landmarks. **A** Horizontal widths: *a* temporal, *b* bizygomatic, *c* bigonial. **B** Vertical face heights: *d* upper, *e* middle, *f* lower. **C** Oblique: *g* distance between pogonion and gonion

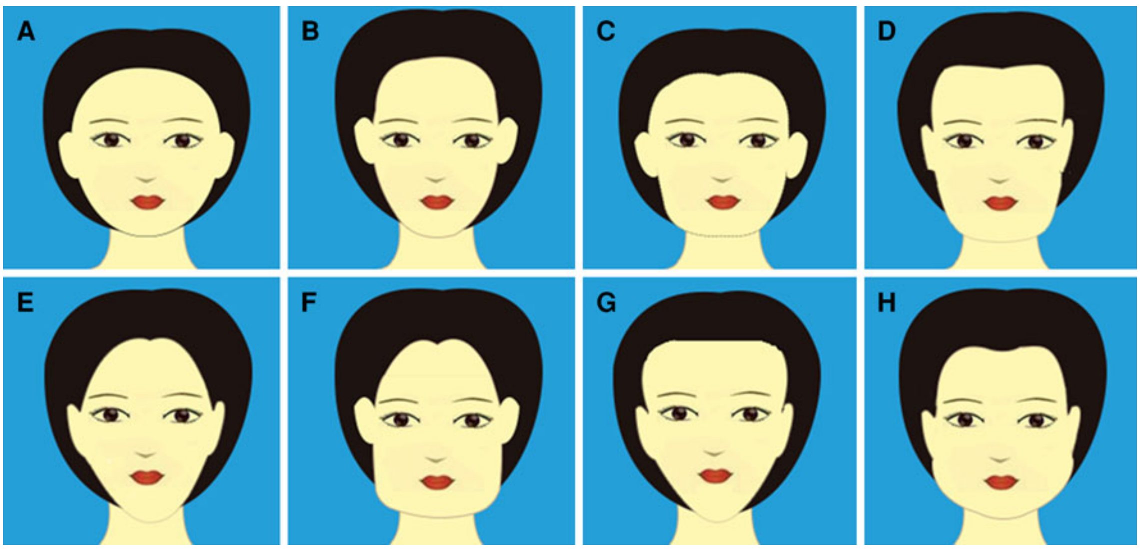

Fig. 2 Simple *line* diagrams of the eight different shapes of the face. **A** Round face. **B** Oval face. **C** Square face. **D** Rectangular face. **E** Diamond face. **F** Triangular face. **G** Inverted triangle face. **H** Trapezoidal face

Construction of Synthetic Attractive Faces for Each Face Type

We selected the eight most attractive faces of each classification to produce a computer-generated face for each facial type. To construct the synthetic faces, we used an image-morphing computer anamorphic algorithm. First, the feature points of all eight faces of each facial type were input into an Active Appearance Model (AAM) algorithm (Matlab® Central, The MathWorks, Natick, MA). The feature points were then interpreted using a bilinear interpolation algorithm (Fig. 3). Figure 4 shows the results of the eight synthetically produced facial types.

Statistical Analyses

Single-factor analysis of variance (ANOVA) was performed to verify the significance of the attractiveness scores and the proportions of the seven indicators among different faces. The data are given as the mean ± standard deviation. A P value < 0.05 was considered significant. Levene's test was performed, determining that the ordinal values were randomly distributed and suitable for ANOVA. A Bayesian discriminant analysis was used to develop mathematical models of facial classification. All faces were sorted according to the attractiveness score. All measurement data were analyzed using statistical analysis software SPSS 17.0 (SPSS, Chicago, IL).

Results

Ratios to Determine Facial Attractiveness

Each of the eight facial types were characterized by calculated ratios (relative proportions) between pairs of the averaged seven facial landmarks taken from all the faces of each type (Table 2). These ratios are overall face length to bizygomatic width, temporal width to bizygomatic width, bizygomatic width to bigonial width, temporal width to bigonial width, upper-face height to middle-face height, middle-face height to lower-face height, upper-face height to lower-face height, and overall face length to the distance between the pogonion and gonion. Relative to the bizygomatic width (referenced as 1.00), the average temporal width for all faces ($n = 450$) was 0.824, while that of the most attractive faces ($n = 45$) was 0.827; the bigonial widths were 0.880 and 0.869, respectively (Table 3). Relative to the length of the middle face, the upper-face height for all faces was 1.014 and that of the most attractive was 0.999; the corresponding ratio for the lower-face heights was 1.00 and 0.984. These differences between the respective averages for all faces and those of only the most attractive were significant, and also significantly different from North American Caucasian faces ($n = 200$; $P < 0.05$; Table 4).

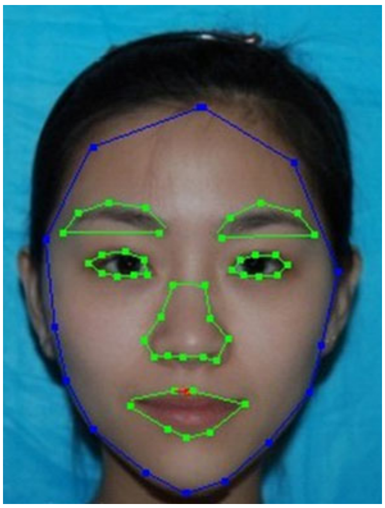

Fig. 3 Facial feature points

Mathematical Modeling of Facial Classification

Bayesian discriminant analysis was applied to classify faces using the function:

$$Y = C_0 + C_1X_1 + C_2X_2 + \ldots + C_mX_m,$$

where C is the coefficient and X is the variable. X_1 is the temporal width, X_2 is the bizygomatic width, X_3 is the pogonion, and X_4 is the lower-face height. The maximum of Y is related to the type of face. The calculated coefficients (i.e., C_m for each term in the equation above) for face classification discrimination are given in Table 5. Faces therefore fell into eight types: round, oval, square, rectangular, diamond, triangular, inverted triangle and trapezoidal.

Fig. 4 The synthetic images of the eight different face types. **A** Round face. **B** Oval face. **C** Square face. **D** Rectangular face. **E** Diamond face. **F** Triangular face. **G** Inverted triangle face. **H** Trapezoidal face

Table 2 Ratio of measurement data of the eight different shapes of the face

	Round	Oval	Square	Rectangular	Diamond	Triangular	Inverted triangular	Trapezoidal
Length of face : bizygomatic breadth	1.205 ± 0.067	1.331 ± 0.070	1.200 ± 0.079	1.288 ± 0.073	1.313 ± 0.078	1.253 ± 0.078	1.284 ± 0.075	1.181 ± 0.052
Temporal width : bizygomatic breadth	0.818 ± 0.029	0.834 ± 0.033	0.828 ± 0.027	0.829 ± 0.073	0.807 ± 0.027	0.796 ± 0.078	0.824 ± 0.034	0.843 ± 0.044
Bizygomatic breadth : bigonial breadth	1.137 ± 0.038	1.150 ± 0.028	1.112 ± 0.028	1.131 ± 0.038	1.157 ± 0.027	1.102 ± 0.044	1.189 ± 0.057	1.081 ± 0.041
Temporal width : bigonial breadth	0.930 ± 0.041	0.959 ± 0.033	0.921 ± 0.030	0.937 ± 0.052	0.934 ± 0.036	0.877 ± 0.035	0.978 ± 0.043	0.911 ± 0.053
Upper-face height : middle-face height	1.019 ± 0.080	1.014 ± 0.081	1.014 ± 0.080	1.001 ± 0.069	1.002 ± 0.092	1.076 ± 0.093	1.004 ± 0.051	1.033 ± 0.112
Middle-face height : lower-face height	1.019 ± 0.064	0.988 ± 0.052	1.006 ± 0.057	1.015 ± 0.055	0.970 ± 0.056	0.958 ± 0.070	1.00084 ± 0.051	1.048 ± 0.093
Upper-face height : lower-face height	1.038 ± 0.090	1.002 ± 0.092	1.017 ± 0.067	1.016 ± 0.092	0.971 ± 0.087	1.029 ± 0.093	1.007 ± 0.090	1.081 ± 0.149
Length of face : distance between pogonion and gonion	1.791 ± 0.142	1.980 ± 0.168	1.796 ± 0.144	1.874 ± 0.133	1.955 ± 0.164	1.788 ± 0.168	1.939 ± 0.150	1.724 ± 0.935

Data are given as mean ($\bar{x}$) ± SD

Table 3 Ratio of measurement data of all faces and beautiful faces

	All faces (n = 450)	Beautiful faces (beauty score >3.5, n = 45)
Length of face : bizygomatic breadth	1.273	1.277
Temporal width : bizygomatic breadth	0.824	0.827
Bizygomatic breadth : bigonial breadth	1.136	1.151
Temporal width : bigonial breadth	0.936	0.952
Upper-face height : middle-face height	1.014	0.999
Middle-face height : lower-face height	1.000	1.016
Upper-face height : lower-face height	1.013	1.015
Length of face : distance between pogonion and gonion	1.880	1.830

Data are mean ($\bar{x}$)

Table 4 Mean ($\bar{x}$) of measurement data of all faces, beautiful faces and North American faces

	All faces (n = 450)	Beautiful faces (beauty score >3.5, n = 45)	North American faces [3] (n = 200)
Temporal width	11.895	11.933	–
Bizygomatic breadth	14.437	14.354	13.00
Bigonial breadth	12.724	12.413	–
Upper-face height	6.163	6.162	5.27
Middle-face height	6.088	6.096	6.31
Lower-face height	6.100	6.071	6.43
Length of face	18.351	18.330	18.01
Distance between pogonion and gonion	9.846	9.933	–

Variables for the upper-face height, middle-face height, and the distance between the pogonion and gonion were removed from analysis because they did not correlate strongly with facial types. The classification discriminant function for each type of face was determined with the above results (Table 6). As with the initial grouping, the correct judgment rates for facial types were 44.8, 36.7, 27.6, 20.0, 48.0, 57.1, 66.7, and 85.7 % for round, oval, square, rectangular, diamond, triangular, inverted triangle and trapezoidal faces, respectively. After cross-validation, the rates were 41.4, 34.7, 24.1, 18.3, 48.0, 50.0, 50.0, and 42.9 %, respectively.

Table 5 Coefficients of classification discriminant function

Variable	Round face	Oval face	Square face	Rectangular face	Diamond face	Triangular face	Inverted triangular face	Trapezoidal face
Temporal width (X_1)	17.651	17.110	18.145	17.165	15.071	14.260	17.720	20.463
Bizygomatic breadth (X_2)	42.271	39.719	40.231	39.305	40.986	39.302	41.996	38.370
Bigonial breadth (X_3)	22.297	19.971	23.547	21.826	19.987	24.453	17.805	25.357
Lower face height (X_4)	17.080	21.061	16.983	19.335	21.908	19.628	19.337	13.906
Constant (C_0)	−624.723	−575.714	−616.381	−582.913	−575.523	−584.650	−578.183	−624.295

Table 6 Facial classification discriminant function

Face	Facial classification discriminant function
Round face	$Y_1 = -624.723 + 17.651X_1 + 42.271X_2 + 22.297X_3 + 17.080X_4$
Oval face	$Y_2 = -575.714 + 17.110X_1 + 39.719X_2 + 19.971X_3 + 21.061X_4$
Square face	$Y_3 = -616.381 + 18.145X_1 + 40.231X_2 + 23.547X_3 + 16.983X_4$
Rectangular face	$Y_4 = -582.913 + 17.165X_1 + 39.305X_2 + 21.826X_3 + 19.335X_4$
Diamond face	$Y_5 = -575.523 + 15.071X_1 + 40.986X_2 + 19.987X_3 + 21.908X_4$
Triangular face	$Y_6 = -584.650 + 14.260X_1 + 39.302X_2 + 24.453X_3 + 19.628X_4$
Inverted triangular face	$Y_7 = -578.183 + 17.720X_1 + 41.996X_2 + 17.805X_3 + 19.337X_4$
Trapezoidal face	$Y_8 = -624.295 + 20.463X_1 + 38.370X_2 + 25.357X_3 + 13.906X_4$

Scores of Attractiveness for Facial Types and Correlation Analysis

Table 7 gives the attractiveness scores for each type of face and Table 8 gives the probabilities that the differences in attractiveness ratings between face types is due to chance. The face types ordered by average attractiveness scores, from highest to lowest, are the inverted triangle (3.250 ± 0.549), oval (3.90 ± 0.457), rectangular (2.969 ± 0.058), round (2.877 ± 0.484), diamond (2.651 ± 0.591), square (2.636 ± 0.085), triangular (2.602 ± 0.119), and trapezoidal (2.531 ± 0.149).

Table 7 Beautiful scores of faces

Face	No. of people	Beautiful scores[a]
Round face	58	2.877 ± 0.484
Oval face	94	3.190 ± 0.457
Square face	58	2.636 ± 0.085
Rectangular face	120	2.969 ± 0.058
Diamond face	50	2.651 ± 0.591
Triangular face	28	2.602 ± 0.119
Inverted triangular face	28	3.250 ± 0.549
Trapezoidal face	14	2.531 ± 0.149

[a] Data are given as mean ($\bar{x}$) ± SD

Facial Classification of Known Celebrities, Singers, and Actresses

The faces of known celebrities, singers, and actresses all fell within the classifications of round, oval, square, rectangular, diamond, or inverted triangle. We found that the faces of Li Xiang and Deng Lijun belong to the round-face classification; Maggie Cheung is between round and oval; Xu Qing, Liu Yifei, and Gong Li belong to the oval-face category; Shu Qi, Yang Ziqiong, and Zhou Tao have rectangular faces; Zhang Ziyi is between oval and inverted triangular; Fan Bingbing and Li Xiaolu belong to the inverted-triangular-face category; Cai Shaofen and Dong Qing have diamond faces; and Li Yuchun has a square face.

Production of Synthetic Facial Forms

To construct synthetic attractive faces, an image-morphing computer anamorphic algorithm was utilized. First, the feature points of every face were entered into an Active Appearance Model (AAM) algorithm. These 58 feature points (facial shape, 14; eyebrows, 10; eyes, 16; nose, 11; mouth, 7) are illustrated in Fig. 3. Then, the synthetic figure points of many faces were positioned using a bilinear interpolation algorithm. The results of the synthesis of the eight types of attractive facial forms are shown in Fig. 4.

Table 8 Probabilities that the differences in attractiveness ratings between face types are due to chance

Round face							
Oval face	0.006						
Square face	0.056	0.000					
Rectangular face	0.395	0.018	0.002				
Diamond face	0.086	0.000	0.903	0.006			
Triangular face	0.079	0.000	0.830	0.010	0.757		
Inverted triangular face	0.024	0.695	0.000	0.065	0.000	0.001	
Trapezoidal face	0.087	0.001	0.603	0.023	0.555	0.747	0.002
Face	Round face	Oval face	Square face	Rectangular face	Diamond face	Triangular face	Inverted triangular face

Results

Relative to middle-face height (i.e., set at 1.00) the upper- and lower-face heights were 0.999 and 0.984, respectively, for attractive Han women in this population. Higher attractiveness scores were associated with slightly smaller absolute values for the upper-, middle-, and lower-face heights, an increased middle-face height to total-face height ratio, and slightly smaller ratios for the upper-face height and lower-face height to the total-face height. These faces departed from the neoclassical ideal of attractiveness in which the nose occupies the middle third of the face [3].

For attractive Han women, the temporal width to bizygomatic width ratio was 0.827 and the bigonial width to bizygomatic width ratio was 0.869. Higher attractiveness ratings were associated with greater temporal width and pogonion–gonion distance and smaller bizygomatic and bigonial widths. The ratio of the temporal width to the bizygomatic width was higher, and the ratio of the distance between the pogonion and gonion to the bizygomatic width also was slightly higher.

A Bayesian discriminant analysis was used to establish a mathematic model of facial classification. The results implied that the inverted triangular and oval faces tended to be the most beautiful, then the rectangular and round, followed by the diamond, square, triangular, and the trapezoidal.

Discussion

Quantitating Facial Aesthetics

Facial classification and aesthetic judgments are the basis of human facial aesthetics and plastic surgery decisions. However, no widely accepted quantitative face classification system exists for the Chinese Han face. The morphology method (i.e., Boych method) and the index method of face classification mentioned in the literature are not practical for clinical use [4]. Morphological methods include the Boych, the font, the Asian facial form, and the Chinese facial form [4–6]. However, none of these methods provides quantitative diagnostic criteria. Head and face index classification uses only two measured values, making it too simple a method to use to describe facial forms. Although some studies have analyzed the “attractive face” in detail [2, 3, 7–9], they did not classify faces into generalized types. In our study, statistical analysis of facial indicators and mathematical modeling of facial classifications established with these measurements confirm the strong practical value of facial classification.

Analysis of Facial Measurements

Vertical Measurements

According to classical aesthetics, the vertical upper, middle, and lower face of the ideal face should all be equal in length. We found that in the general population, the ratio of upper-face height to middle-face height was slightly higher (1.014) and for attractive people the upper- and lower-face heights were slightly less than the middle-face height (i.e., 0.999 and 0.984, respectively, of the middle). Higher attractiveness scores were associated with higher ratios of the middle-face height to the total-face height and slightly smaller ratios of the upper- and lower-face heights to the total-face height. For the Caucasian face [10], the upper- and lower-face lengths were 0.821 and 1.036, respectively, of the middle-face length for the general population, and 0.739 and 0.989 of the middle-face length for attractive people. The upper- and lower-face heights became smaller in relation to the total face height as the face increased in attractiveness. Our findings were similar, although we found a smaller upper-face height ratio for the entire face. We therefore conclude that the neoclassical ideals [11] are not appropriate for the female Chinese Han face. Further research is needed to explore modern aesthetic standards. Greater feminization corresponds to a shorter lower face and upwardly displaced brows [12]. Therefore, our findings that greater attractiveness in Han women corresponds to a relatively longer midface may be due to a feminizing quality that correlates with beauty. However, since men were not included in the study, we cannot rule out factors other than feminization as the contributory factor.

Horizontal Measurements

For the general population, temporal and bigonial widths were 0.824 and 0.88, respectively, of the bizygomatic width, and for attractive people they were 0.827 and 0.869. We concluded that as attractiveness increased, the ratio of the temporal width to the bizygomatic width increased, and the ratio of bigonial breadth to the bizygomatic breadth narrowed slightly. Farkas et al. [13] reported on an international anthropometric study of facial morphology in various ethnic groups and races in 2005. Compared with other Asian ethnic groups such as Singaporean Chinese, Vietnamese, Indians, Thai, and Japanese, the bizygomatic and bigonial widths of Chinese Han faces were slightly greater [13, 14]. This also reflects our clinical experience.

Chinese women seek reduction plasty of the mala and zygoma, masseter muscle injection with botulinum toxin A (Botox), and mandibular angle osteotomy to obtain a more attractive face. Since greater attractiveness corresponds to decreased breadth of the middle and lower face, decreased vertical dimensions, and oval or inverted triangular faces, we find that more attractive Han female faces tend to have a smaller and less robust appearance. The greater salience of increased temporal width is likely related to factors other than feminization or robusticity.

Analysis of Facial Measurements

An attractive face has a greater temporal width, but the bizygomatic and bigonial breadths are smaller (Table 4). The upper-, middle-, and lower-face heights are shorter and the distance between the pogonion and gonion is greater than those for the general population. The pogonion is a very important index of chin aesthetics, with a more prominent pogonion in profile view corresponding to a more beautiful chin. For this reason, many patients request chin augmentation to extend this index. Compared with a Caucasian woman, the young Korean woman has a greater bizygomatic breadth, greater vertical dimensions (face length, upper face, middle face, and lower face), and a shorter nasal length [1]. In a sample of Italian women, it was reported that greater attractiveness corresponds to a shape component comprising a smaller vertical height of the lower jaw, decreased alveolar prognathism, and greater prominence of the pogonion/chin [15]. This component was unrelated to feminization. Notice that feminization makes the lower jaw and chin relatively smaller and the alveolar region relatively more prognathic for a given face size [16]. Chances are that our finding that more attractive Han female faces tend to have more prominent chins in profile view corresponds to the same shape component reported by Valenzano et al. [15].

Relative Attractiveness of Facial Types

In the present study, the proportions of different facial measurements were examined to compare eight facial types. We found that the oval face had the maximum ratio of total face length to bizygomatic breadth, giving the appearance of a long, narrow face (Table 2). By contrast, this ratio was at a minimum in the trapezoidal face, giving the appearance of a short, wide face. The inverted triangular face had the maximum ratio of bizygomatic width to bigonial width, resulting in a face with a relatively narrow mandible. The inverted triangular face also had the maximum ratio of upper-face height to middle-face height and the minimum ratio of middle-face height to lower-face height, since it had a relatively shorter middle face. These proportions were consistent with our clinical practice.

Mathematical Modeling of Facial Classification

Our study is the first to establish a mathematical model of facial classification and quantitative measurement using Bayesian discriminant analysis. No similar study has been reported in the literature. However, the correct judgment rate is not very high, especially with square and rectangular faces. The chief reasons may be, first, that each face is unique. Although we divided the faces into eight types, individual faces are sometimes very difficult to classify. Second, the number of measured sites was limited. Due to the large sample for screening, we chose the seven most representative measurements to compensate for the limitations imposed by the number and compliance of subjects. These limitations affect all systems of facial classification to some extent. How to overcome the subjectivity of classification and limited face measurement data needs to be addressed in future research.

The Popular Image of Attractiveness

The inverted-triangular- and oval-face types were considered by the public to be the most attractive (Tables 6; 7). This view differs slightly from the traditional Chinese view, which prefers the oval face as the most beautiful [6]. The difference may be a result of sampling. Indicators of maturity, feminization, and deviation from ancestral robusticity contribute to female facial attractiveness. In some samples, ovalization of the face in the Han will load more heavily on the ancestral robusticity factor than inverted triangularization, tending to make inverted triangular faces more attractive. Therefore, cosmetic surgeons should adapt to the patient's preferences rather than abide by a rule of thumb that an oval or inverted triangular face is necessarily better looking; this should also be evident in the overlapping distributions of attractiveness among face types. Our results reflect current aesthetic demands in plastic surgery.

Many people want temporal filling, reduction plasty of the mala and zygoma, mandibular osteotomy, botulinum toxin injection to the masseter muscle, and other plastic surgeries to attain an inverted triangular face like that of the popular actress Fan Bingbing, who has a relatively greater temporal width and smaller bizygomatic width and bigonial width. Another example of an attractive Chinese female face is that of the internationally renowned actress Zhang Ziyi, widely considered very attractive in China, whose face is between an oval and an inverted triangular type.

In 2010, the Korean professor Rhee [17] described attractiveness in Asian faces by synthesizing the images of popular actresses. The ideal Chinese female face (the average of 20 actresses) had a narrow bizygomatic breadth, slightly thin cheeks, and a more prominent chin, making it relatively close to the inverted-triangular-face type. The round and rectangular faces were the next most attractive. The total-face length to bizygomatic breadth ratio of the round face was smaller than that for the inverted triangular or oval face. For these faces, chin augmentation may help increase the total-face length. By the same token, the temporal width to bigonial breadth ratio was smaller for the rectangular face than for the inverted triangular or oval face. In these cases, mandibular angle osteotomy will help decrease the bigonial breadth.

The trapezoidal face was the least attractive in this study. The trapezoidal face has an overdeveloped mandibular angle, making it seem to expand and fall, and the chin is also poorly developed. Two mandibular angle points and a pogonion lying approximately horizontal as seen from a frontal view makes this face deviate from public standards of aesthetic attractiveness.

Synthetic Images of Attractive Facial Types

Making synthetic facial form figures using an image-morphing computer anamorphic algorithm allows standardization of facial types. Such an effort has not previously been reported in the literature for Chinese Han faces. Rhee and Lee [17] synthesized facial form figures but did not classify the faces. The synthetic images (Fig. 4) are more life-like than the previous hand-drawn sketches used to illustrate the attributes of each facial type.

Conflict of interest The authors have no conflict of interest to disclose.

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