ORIGINAL ARTICLE

The Korean American Woman's Face

Anthropometric Measurements and Quantitative Analysis of Facial Aesthetics

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Objectives: To assess the differences in facial proportions between Korean American (KA) women and North American white (NAW) women and to quantitatively describe aesthetic facial features in the KA women.

Design: Anthropometric survey and facial aesthetic evaluation.

Participants: Volunteer sample of KA women (n=72) who served as models for part 1 of the study and a different sample of KA women (n=5) and men (n=5) who served as judges for part 2 of the study. All subjects were between ages 18 and 35 years and had Korean parents and no previous facial surgery or trauma.

Intervention: For part 1 of the study, standardized and referenced frontal and lateral photographs were taken of the models, and 26 standard anthropometric measurements were determined. Results were compared with published NAW standards. For part 2 of the study, 10 judges evaluated frontal views of the models for facial aesthetics using a visual analog scale. Quantitative analysis was done of the faces of attractive KA women (>90th percentile in aesthetic scores) and comparisons were made with the faces of NAW women and average KA women.

Results: The KA woman's face did not fit the neoclassical facial canons. Compared with NAW women, 24 of the 26 facial measurements in KA women were significantly different. Only 9 of the 26 facial measurements were significantly different when the attractive KA women were compared with the NAW women. Nine of the 17 nonsignificant facial measurements were very similar to those of the NAW women; many of these facial features centered around the midface.

Conclusions: Although the average KA woman's facial anthropometric measurements were very different from those of the NAW woman, attractive KA women reflected many of the facial features of NAW women. These findings support the need for ethnically sensitive facial canons and further research into transcultural aesthetics.

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FACIAL BEAUTY ARISES FROM symmetric, balanced, and harmonious proportions. Reestablishment of facial harmony requires restoration of proportional facial structures and elimination of disproportionate relationships. The optimal relationships between facial structures are used to assess the face during aesthetic and reconstructive consultations.

Although facial analysis and proportions are well discussed in whites[1-3] and African Americans,[4-7] only a limited number of studies exist for Asians,[8-11] and none exist for Asian Americans. Aesthetic surgery on Asian American patients relying on white norms may result in dissonant facial proportions. Furthermore, many Asian Americans seek to maintain their ethnicity through cosmetic procedures. The challenge for surgeons is to maintain appropriate ethnic facial features and correct only the features that are disproportionate to the rest of the face.

As illustrated by the work of artists and anatomists of the 17th to the 19th centuries, the concept of beauty and "normal" facial proportions has changed with time. Furthermore, as the population becomes more heterogeneous, new facial proportions have emerged from interracial mixing. It is now apparent that what has been considered beautiful and acceptable as the norm for one culture may be different for another. Inherently, the notion of a single aesthetic standard and beauty is grossly inadequate and naïve. What is required is a new model of aesthetic standards and beauty that is unique to different ethnic groups to better fit their facial skeletal and skin profile and culture.

This study assesses the differences in facial proportions between Korean Ameri-

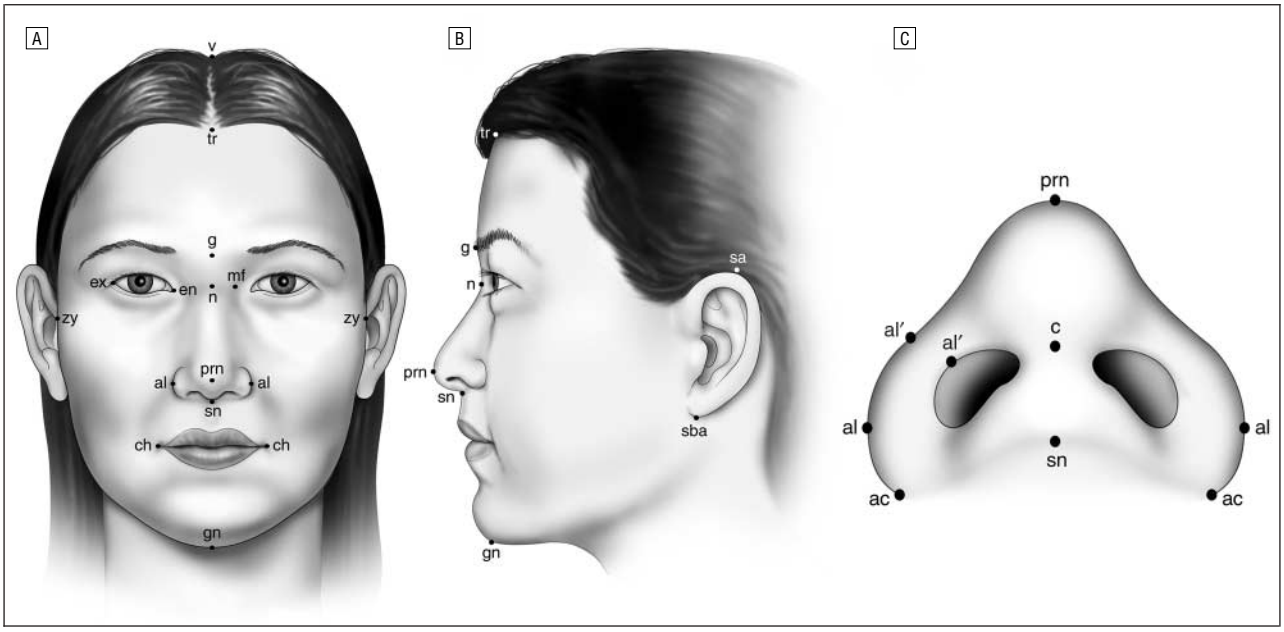

Figure 1. Frontal (A), lateral (B), and basal (C) views of the average Korean American woman's face. ac indicates alar curvature point; al, alare; al′, alar rim; c, highest point of the columella; ch, cheillion; en, endocanthion; ex, exocanthion; g, glabella; gn, gnathion; mf, maxillofrontale; n, nasion; prn, pronasale; sa, superaurale; sba, subaurale; sn, subnasale; tr, trichion; and zy, zygion.

can (KA) women and North American white (NAW) women, and it also describes aesthetic facial features in the typical KA woman. The quantitative determinations will be useful in preoperative and postoperative facial assessment for cosmetic and reconstructive purposes.

METHODS

Seventy-two KA women volunteered as subjects (models) and an additional 10 KA persons volunteered as judges (5 women and 5 men). All participants were between ages 18 and 35 years and had no previous facial trauma or cosmetic surgery. All subjects were of full Korean descent.

Demographic data included age, place of birth, length of stay in the United States, and parental heritage. Digital photographs (Sony Mavica-300; Sony Corp, Tokyo, Japan) of the models' faces were obtained in frontal, left lateral, and basal views. A ruler was included in each image for calibration.

Photographs were analyzed with Mirror Image software (Canfield Corp, Fairfield, NJ), and anthropometric measurements were obtained based on facial soft tissue landmarks (**Figure 1**). Twenty-six standard anthropometric measurements were obtained, including special forehead height (vertex-endocanthion), special face height (endocanthion-gnathion), forehead height 1 (trichion-glabella), forehead height 2 (trichion-nasion), total nasal length (nasion-subnasale), nasal length (nasion–tip-defining point), tip protrusion (subnasale–tip-defining point), lower face height (subnasale-gnathion), calva height (vertex-trichion), special upper face height (glabella-subnasale), ear length (superaurale-subaurale), interocular distance (endocanthion-endocanthion), eye fissure width (exocanthion-endocanthion), mouth width (cheilion-cheilion), facial width (zygion-zygion), lower-lip thickness, total lip thickness, nasal root (midfacial line-midfacial line), nasal width (widest point on ala-widest point on ala), alar thickness (inner and outer alar rim), columella length (subnasale-top of columella), alar length (alar crease–tip-defining point), ear incline angle, nasofrontal angle, nasofacial angle, and nasolabial angle.[1-4]

In part 1 of the study, the results were compared with previously published standards for NAW women.[1-3] Data were analyzed using an unpaired *t* test if the variables of 2 samples were equal or an unpaired *t* test with the Welch correction if the variables of 2 samples were unequal owing to unequal population size. We assessed the differences between our results and those of others using the overall chance of type I error as $P<.05$.

In part 2 of the study, the frontal views of the models were evaluated by 10 judges for facial aesthetics using a visual analog scale. The aesthetic scores were correlated with anthropometric data. Facial features of high-scoring KA women, the remaining KA women, and NAW were quantitatively analyzed and compared. Results were further analyzed using both bivariate correlation and multiple regression. The variables that were significantly related to total aesthetic scoring were revealed as well as their contribution to the predictability of the total aesthetic scoring. This study was approved by the institutional review board for human experimentation of The New York Eye and Ear Infirmary.

RESULTS

DEMOGRAPHIC DATA

Seventy-two KA women were enrolled as subjects for part 1 of the study. The subjects had an average age of 25 years (range, 18-35 years). Most subjects (90%) were born in South Korea and the others (10%) were born in the United States. The average length of stay in the United States was 10 years (range, 1 month to 28 years). Ten KA subjects (5 women and 5 men) participated as judges for part 2 of the study. The judges were pooled from a different community and had an average age of 30 years (range, 27-32 years). Most judges (87%) were born in South Korea, and the others (13%) were born in the United States. The average length of residence in the United States was 17 years (range, 1 month to 28 years).

Table 1. Comparison of Anthropometric Facial Measurements in Korean American and North American White Women

Anthropometric Measure	Mean (SD) Size*		Mean Difference	*P* Value
	Korean American Women (n = 72)	White Women (n = 200)		
Special forehead height (v-en)	112.1 (7.9)	118.7 (6.1)	−6.6	<.001
Special face height (en-gn)	111.5 (7.1)	102.7 (5.1)	8.8	<.001
Forehead height 1 (tr-g)	57.7 (6.4)	52.7 (6.0)	5.0	<.001
Forehead height 2 (tr-n)	73.7 (7.0)	63.0 (6.0)	10.7	<.001
Total nasal length (n-sn)	51.8 (4.4)	50.6 (3.1)	1.2	.01
Nasal length (n-prn)	43.5 (3.9)	44.7 (3.4)	−1.2	.01
Tip protrusion (sn-prn)	19.6 (1.4)	19.7 (1.6)	0.1	>.05
Lower face height (sn-gn)	66.8 (5.6)	64.3 (4.0)	2.5	.001
Calva height (v-tr)	31.2 (7.4)	47.4 (8.0)	−16.2	<.001
Special upper face height (g-sn)	67.9 (5.0)	63.1 (4.4)	4.8	<.001
Ear length (s-sba)	67.6 (4.8)	59.6 (3.4)	8.0	<.001
Interocular distance (en-en)	36.9 (3.4)	31.8 (2.3)	5.1	<.001
Eye fissure width (ex-en)	27.3 (2.0)	30.7 (1.2)	−3.4	<.001
Mouth width (ch-ch)	50.2 (4.0)	50.2 (3.5)	0.0	>.05
Facial width (zy-zy)	139.0 (8.6)	130.0 (4.6)	9.0	<.001
Lower-lip thickness	11.0 (2.4)	9.4 (1.5)	1.6	<.001
Total lip thickness	19.1 (2.9)	18.1 (2.8)	1.0	.01
Nasal root (mf-mf)	21.1 (4.1)	18.4 (1.9)	2.7	<.001
Nasal width (al-al)	35.5 (3.4)	31.4 (2.0)	4.1	<.001
Alar thickness (al′-al′)	4.5 (0.8)	5.3 (0.7)	−0.8	<.001
Columella length (c-sn)	7.6 (1.1)	11.5 (1.7)	−3.9	<.001
Alar length (ac-prn)	29.9 (3.1)	31.5 (1.8)	−1.6	<.001
Ear incline angle, °	15.8 (5.3)	17.5 (4.6)	−1.7	.01
Nasofrontal angle, °	136.8 (6.4)	134.3 (7.0)	2.5	.008
Nasofacial angle, °	32.3 (5.1)	29.9 (3.9)	2.5	.001
Nasolabial angle, °	92.1 (9.2)	104.2 (9.8)	−12.1	<.001

Abbreviations: ac, alar curvature point; al, alare; al′, alar rim; c, highest point of the columella; ch, cheillion; en, endocanthion; ex, exocanthion; g, glabella; gn, gnathion; mf, maxillofrontale; n, nasion; prn, pronasale; sa, superaurale; sba, subaurale; sn, subnasale; tr, trichion; v, vertex; zy, zygion.
*Unless otherwise noted, data are millimeters.

PART 1

Anthropometric facial measurements in KA women and published NAW norms[1-3] are summarized in **Table 1**. A statistically significant difference existed between the KA women and the NAW norms in 24 of our 26 measures taken. Although special head height and calva height were shorter for KA women, the forehead heights 1 and 2 were longer than NAW norms. **Table 2** lists the measurements observed in the KA women and the NAW norm for the neoclassical facial-proportions categories.[2] All of the facial-proportions were statistically different between the KA women and NAW norm ($P<.05$). In the orbitonasal canon, the most frequently valid measurement in KA women was that the distance from endocanthion to endocanthion (en-en) was greater than the distance from alare to alare (al-al) (61% of cases; n=44). The least frequently valid measurement as applied to KA women was that en-en was equal to al-al (only 1% of cases; n=1). The opposite was true for the NAW norm, in which the en-en was equal to al-al in 41% of cases (n=42) and the en-en was greater than al-al in 21% of cases (n=22). Although en-en being greater than the distance from the exocanthion to the endocanthion (ex-en) was the most frequent orbital canon measure for both the KA women and the NAW norm, KA women were more likely than the NAW norm to have en-en be greater than ex-en (100% [n=72] vs 52% [n=53]).

The distance from cheillion to cheillion (ch-ch) being less than 1.5 × al-al in the naso-oral canon was much more common than ch-ch being greater than 1.5 × al-al (68% [n=49] vs 32% [n=23]) in the KA women. The opposite was true for the NAW norm. The al-al being greater than 0.25 × the distance from zygion to zygion (zy-zy) in the nasofacial canon was much more common than the al-al being less than 0.25 × zy-zy (63%[n=45] vs 38% [n=27]) in the KA women. The opposite was true for the NAW norm.

In the comparison of the upper third of the face with the lower third, the upper third being smaller than the lower third was the most frequent finding for both KA women and the NAW norm (89% [n=64] vs 100% [n=103]), but the upper third was larger than the lower third in a substantial number of KA women (11% [n=8]).

In the comparison of the middle third of the face with the lower third, the middle third being larger than the lower third was the most frequent finding (n=39; 54%) followed by the middle third being smaller than the lower third (n=30; 42%) in KA women. The opposite was true for the NAW norm: the middle third was smaller than the lower third most frequently (n=70; 68%) followed by the middle third being larger than the lower third (n=33; 32%).

In the comparison of the middle third of the face with the upper third, the middle third was larger than the upper third most frequently (n=65; 90%) followed

Table 2. The Neoclassical Facial Canon Measurements in Korean American Women and North American White Women*

Neoclassical Canon Category	Korean American (n = 72)	North American White (n = 103)	*P* Value†
Orbitonasal			
en-en<al-al	27 (38)	39 (38)	<.001
en-en = al-al	1 (1)	42 (41)	
en-en>al-al	44 (62)	22 (21)	
Orbital			
en-en<ex-en	0	16 (16)	<.001
en-en = ex-en	0	34 (33)	
en-en>ex-en	72 (100)	53 (52)	
Naso-oral			
ch-ch<1.5 × (al-al)	49 (68)	20 (19)	<.001
ch-ch = 1.5 × (al-al)	0	21 (20)	
ch-ch>1.5 × (al-al)	23 (32)	62 (60)	
Nasofacial			
al-al<0.25 × (zy-zy)	27 (38)	40 (39)	<.001
al-al = 0.25 × (zy-zy)	0	38 (37)	
al-al>0.25 × (zy-zy)	45 (63)	25 (24)	
Horizontal thirds			
Upper (tr-g)>lower (sn-gn)	8 (11)	0	<.001
Upper (tr-g) = lower (sn-gn)	0	0	
Upper (tr-g)<lower (sn-gn)	64 (89)	103 (100)	
Middle (gn-sn)>lower (sn-gn)	39 (54)	33 (32)	<.001
Middle (g-sn) = lower (sn-gn)	3 (4)	0	
Middle (g-sn)<lower (sn-gn)	30 (42)	70 (68)	
Middle (g-sn)>upper (tr-g)	65 (90)	8 (8)	<.001
Middle (g-sn) = upper (tr-g)	0	0	
Middle (g-sn)<upper (tr-g)	7 (10)	95 (93)	
Actual percentage of the total horizontal proportions			
Upper third	30	29	>.05
Middle third	35	35	
Lower third	35	36	

Abbreviations: al, alare; ch, cheillion; en, endocanthion; ex, exocanthion; g, glabella; gn, gnathion; sn, subnasale; tr, trichion; zy, zygion.
*Unless otherwise noted, data are number (percentage) of subjects.
†*P* values were calculated by 2-tailed Fisher exact test.

by the middle third being smaller than the upper third (n=7; 10%) in KA women. The opposite was true for the NAW norm: the middle third was smaller than than the upper third most frequently (n=95; 93%) followed by the middle third being larger than the upper third (n=8; 8%). The faces of the KA women were approximately divided into horizontal thirds, and the upper third of the face was slightly longer than the NAW norms.

The KA women's faces were wider on average than the NAW norm. They had greater mean facial width (139 mm vs 130 mm) and interocular distance (36.9 mm vs 31.8 mm) but smaller mean eye fissure length (27.3 mm vs 30.7 mm). The KA women had a wider mean nasofrontal angle than the NAW norm (136.8° vs 134.3°) and a wider mean nasofacial angle (32.3° vs 29.9°). The mean nasolabial angle in the KA women was more acute (92.1°) than that of the NAW norm (104.2°). The KA women's nose on average was wider at the base than the NAW norm (35.5 mm vs 31.4 mm), wider at the nasal root (21.1 mm vs 18.4 mm), thinner at the ala (4.5 mm vs 5.3 mm), shorter in columella length (7.6 mm vs 11.5 mm), and shorter in alar length (29.9 mm vs 31.5 mm).

Table 3. Correlation Between Anthropometric Measurements and Aesthetic Scores in Korean American Women

Measurement	r_p	*P* Value
Special forehead height (v-en)	−0.09	.44
Special face height (en-gn)	−0.31	.008*
Forehead height 1(tr-g)	−0.04	.74
Forehead height 2 (tr-n)	−0.15	.21
Total nasal length (n-sn)	−0.01	.94
Nasal length (n-prn)	0.01	.90
Tip protrusion (sn-prn)	0.11	.37
Lower face height (sn-gn)	−0.29	.01*
Calva height (v-tr)	−0.03	.78
Special upper face height (g-sn)	−0.17	.16
Ear length (sa-sba)	−0.21	.08
Interocular distance (en-en)	−0.35	.003*
Eye fissure width (ex-en)	0.04	.73
Mouth width (ch-ch)	−0.34	.004*
Facial width (zy-zy)	−0.34	<.001*
Lower-lip thickness	−0.21	.08
Total lip thickness	−0.43	<.001*
Nasal root (mf-mf)	−0.26	.03*
Nasal width (al-al)	−0.15	.21
Alar thickness (al′-al′)	0.01	.93
Columella length (c-sn)	0.10	.40
Alar length (ac-prn)	−0.22	.06
Ear incline angle, °	0.11	.36
Nasofrontal angle, °	−0.03	.78
Nasofacial angle, °	0.03	.78
Nasolabial angle, °	0.31	.008*

Abbreviations: ac, alar curvature point; al, alare; al′, alar rim; c, highest point of the columella; ch, cheillion; en, endocanthion; ex, exocanthion; g, glabella; gn, gnathion; mf, maxillofrontale; n, nasion; prn, pronasale; r_p, Pearson correlation coefficient; sa, superaurale; sba, subaurale; sn, subnasale; tr, trichion; v, vertex; zy, zygion.
*Statistically significant difference.

The KA women on average had longer ears than the NAW norm (67.6 mm vs 59.6 mm), but their ears were less steeply inclined (15.8° vs 17.5°). The KA women had a mean mouth width equal to the NAW norm (50.2 mm), but their faces were wider, and so the mouth appeared narrower. The KA women had thicker lips (19.1 mm) than the NAW norm (18.1 mm).

PART 2

The color digital photographs (frontal views) of the 72 models from part 1 of the study were rated for facial attractiveness from 0 (lowest) to 10 (highest) using a visual analog scale. The mean±SD aesthetics score of the 72 subjects was 4.62±1.01 (range, 2.7-7.0). The aesthetics scores followed a Gaussian curve, as verified by the Shapiro-Wilk test and a normal probability plot.

Bivariate correlations revealed 8 facial anthropometric measurements that were significantly related to aesthetic scores (**Table 3**): special face height, lower face height, interocular distance, mouth width, facial width, total lip thickness, nasal root width, and nasolabial angle. All of these correlations were significant at $P<.05$, and all were in the predicted direction. Three additional measurements, ear length ($P<.08$), lower-lip thickness ($P<.08$), and alar length ($P<.06$), showed statistical trend but did not reach significance.

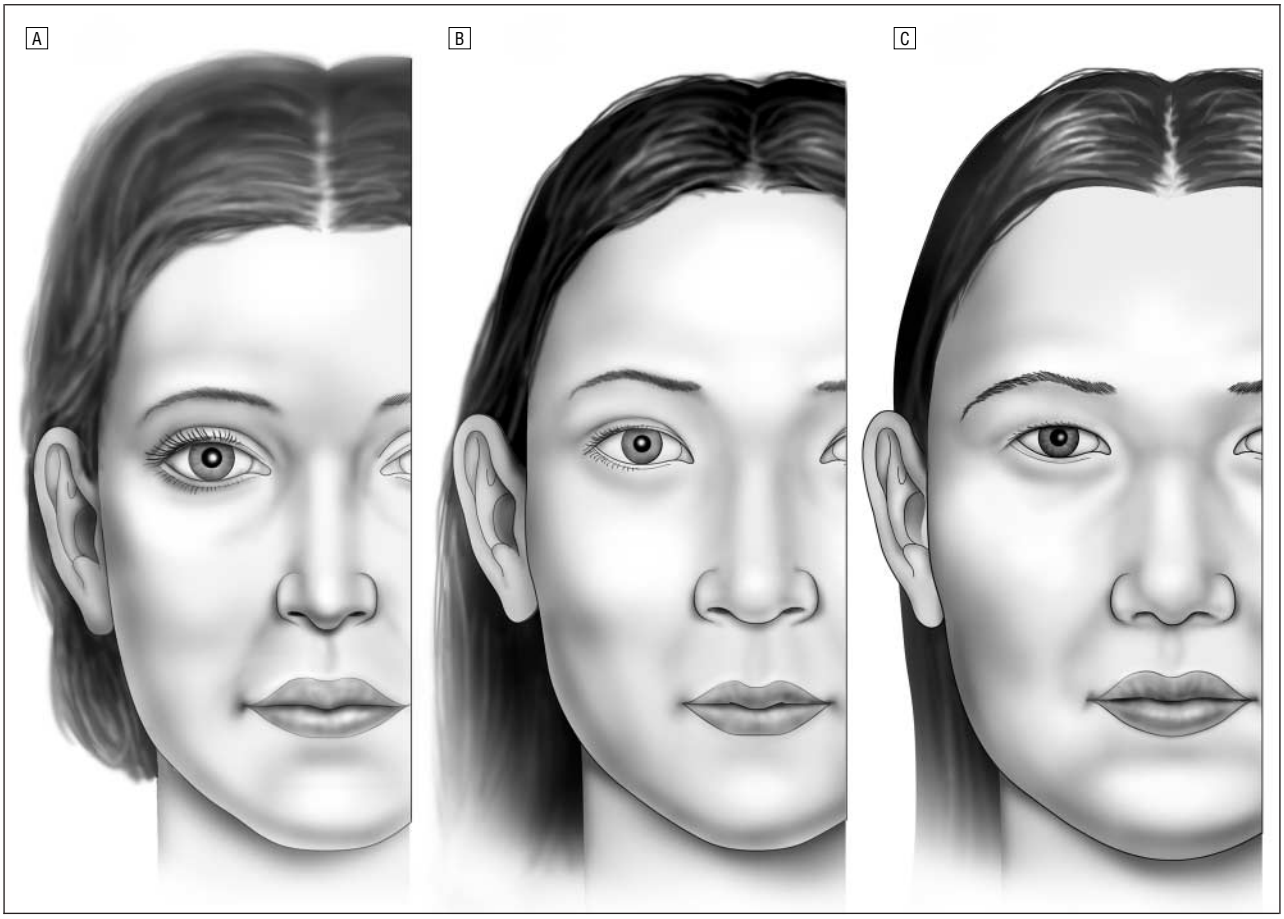

Figure 2. Frontal views of the average North American white woman (A), the attractive Korean American woman (B), and the average Korean American woman (C).

COMPARISONS AND PREDICTIONS

When anthropometric measurements of the KA female subjects with aesthetic scores lower than 5.99 (<90th percentile) were compared with the NAW norms,[1-3] 24 of 26 measurements were statistically different. The mouth width and tip protrusion were the only measurements without statistical significance. When anthropometric measurements of the KA female subjects with aesthetic scores higher than 5.99 (>90th percentile) were compared with the NAW norms,[1-3] only 9 of 26 measurements were statistically different. Of the 17 remaining nonsignificant measurements, 9 measurements were very similar to the NAW norms: nasal length, tip protrusion, lower facial height, lower-lip thickness, total lip thickness, nasal root, alar thickness, ear incline, and nasofacial angle (**Figures 2**, **3**, and **4**; **Table 4**).

The correlation between anthropometric measurements and high aesthetic scorers (>5.99; 90th percentile) were compared with the rest of KA women (**Table 5**). None of the anthropometric measurements reached statistical significance in the high scorers. Ear length ($P=.06$), interocular distance ($P=.10$), and alar thickness ($P=.06$) showed statistical trend.

Through backward elimination multiple regression, total scores were regressed on the linear combination of all 26 measurement variables. The results showed 9 variables that were significantly related to total scoring: facial width, nasofacial angle, eye fissure width, mouth width, alar length, ear length, special head height, nasal length, and nasal width (**Table 6**). The optimum equation containing 9 variables accounted for 46% of the variance in total scoring ($F_{9,62}=5.81$, $P<.01$, adjusted $R^2=0.38$). Examining the variance inflation factors that may cause poorly estimated coefficients, we found all 9 variables to have a magnitude less than 10, which indicates that the estimate of coefficient in the model is relatively stable.

To assess the relative importance of the 9 variables in the prediction of total scoring, we examined the percentage of the variance of each of 9 variables in the total scoring by uniqueness indices. The results indicated that facial width accounted for 18% of the unique variance in total scoring; nasofacial angle, 13%; eye fissure width, 12%; mouth width, 8%; alar length, 8%; ear length, 7%, and special head height, 5%. However, nasal length and nasal width each accounted for less than 5% of the unique variance in total scoring. The variables with a variance of less than 5% are generally considered to be less important, and they may be ignored in predicting dependent variables.

We further assessed the predictive accuracy of the final regression model with 9 variables using a cutoff point of greater than 4.62 (average score for all KA women). The final model had about 65.7% ability (sensitivity) to find the subjects with a total score higher than 4.62, while

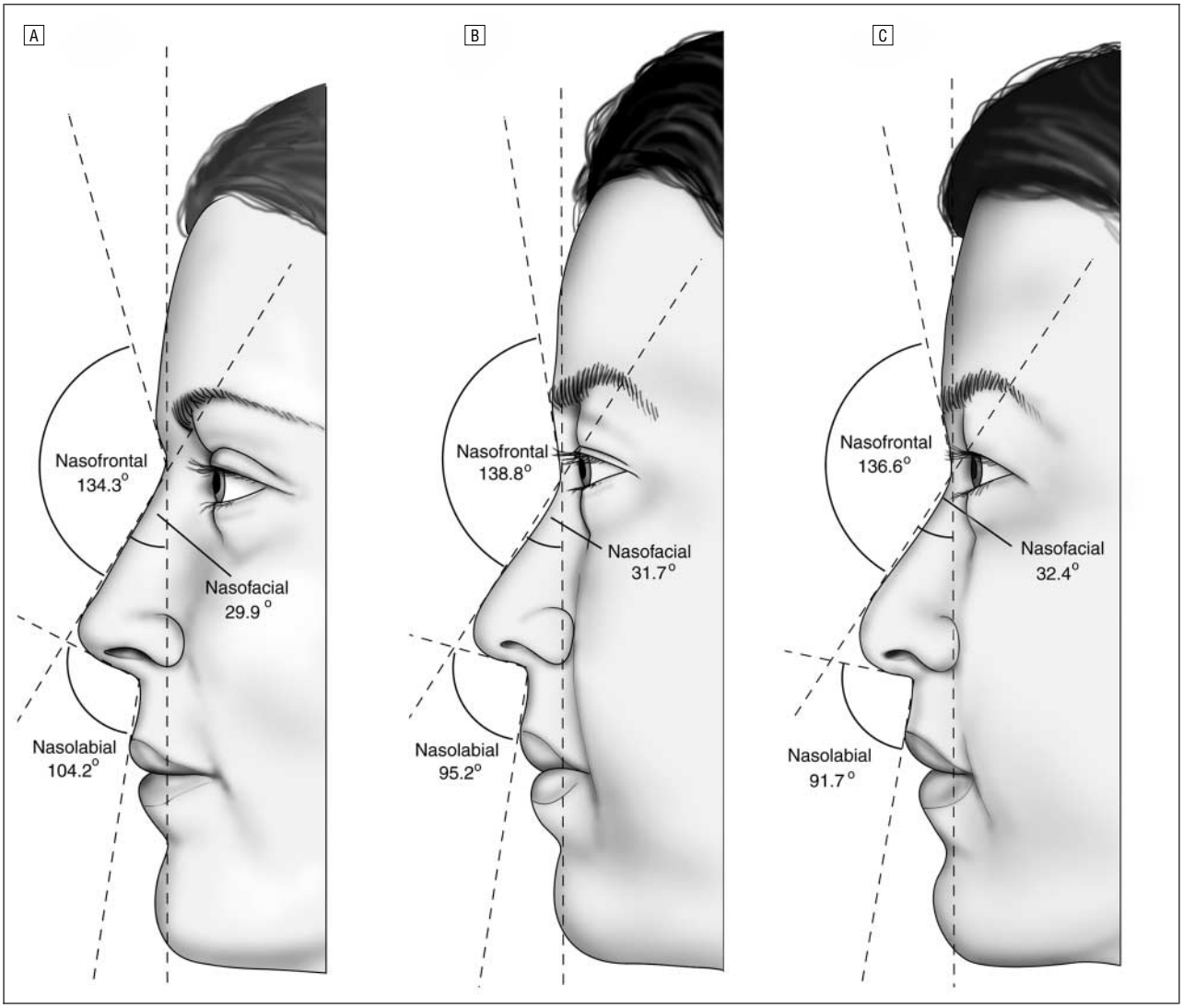

Figure 3. Lateral views, including specified facial angle measurments, of the average North American white woman (A), the attractive Korean American woman (B), and the average Korean American woman (C).

its ability was 67.6% to identify subjects whose scores were equal to or less than 4.62 (specificity). The corresponding rate of model prediction was 65.7%.

COMMENT

Created as guides by scholars and artists of the Renaissance era, the neoclassical canons used to define the relationships among various facial structures were based on classical Greek canons. Although their influence dominated 17th and 18th century art, the neoclassical canons had lost importance by the end of the 19th century. In facial plastic surgery, anatomists propagated the use of the neoclassical canons from the 17th to the 19th centuries, and these canons are still being used as the standard of facial analysis today in the 21st century. Interestingly, these impressions of beauty were never created for surgeons.

There are inherent problems associated with applying outdated artists' impressions of beauty to modern facial analysis and surgery. The subjects used in formulating the neoclassical paradigm were exclusively white. However, this fails to represent the heterogeneity of races and ethnic groups that make up the current US population. In the United States, as in many other parts of the world, interracial marriages are creating original and distinctive ethnic identities and facial appearances. In-

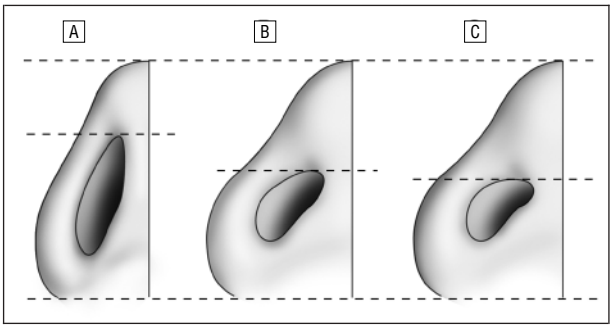

Figure 4. Basal views of the average North American white woman (A), the attractive Korean American woman (B), and the average Korean American woman (C).

Table 4. Comparison of Average Anthropometric Facial Measurements in North American White and Korean American Women*

Anthropometric Measure	North American White Women (n = 200)	Top 10% of Korean American Women (n = 7)	Mean Difference	*P* Value†	Lower 90% of Korean American Women (n = 65)	Mean Difference	*P* Value‡
Special forehead height (v-en)	118.7 (6.1)	112.2 (8.9)	−6.5	>.05	112.1 (7.9)	−6.6	<.001
Special face height (en-gn)	102.7 (5.1)	110.4 (5.9)	7.7	.01	111.6 (7.2)	8.9	<.001
Forehead height 1 (tr-g)	52.7 (6.0)	56.6 (4.4)	3.9	>.05	57.8 (6.5)	5.1	<.001
Forehead height 2 (tr-n)	63.0 (6.0)	73.3 (7.0)	10.3	.01	73.7 (7.1)	10.7	<.001
Total nasal length (n-sn)	50.6 (3.1)	51.7 (5.4)	1.1	>.05	51.8 (4.3)	1.2	.02
Nasal length§ (n-prn)	44.7 (3.4)	43.9 (4.9)	−0.8	>.05	43.4 (3.8)	−1.3	.01
Tip protrusion§ (sn-prn)	19.7 (1.6)	20.0 (1.4)	0.3	>.05	19.5 (1.4)	−0.2	>.05
Lower face height§ (sn-gn)	64.3 (4.0)	65.9 (5.5)	1.6	>.05	66.8 (5.7)	2.5	<.001
Calva height (v-tr)	47.4 (8.0)	30.6 (8.0)	−16.8	.002	31.2 (7.4)	−16.2	<.001
Special upper face height (g-sn)	63.1 (4.4)	69.3 (5.6)	6.2	.03	67.7 (5.0)	4.6	<.001
Ear length (sa-sba)	59.6 (3.4)	66.3 (4.2)	6.7	.006	67.7 (4.8)	8.1	<.001
Interocular distance (en-en)	31.8 (2.3)	36.4 (3.1)	4.6	.01	36.9 (3.4)	5.1	<.001
Eye fissure width (ex-en)	30.7 (1.2)	27.3 (1.4)	−3.4	<.001	27.3 (2.1)	−3.4	<.001
Mouth width (ch-ch)	50.2 (3.5)	47.8 (3.0)	−2.4	>.05	50.5 (4.0)	0.3	>.05
Facial width (zy-zy)	130.0 (4.6)	135.8 (6.4)	5.8	>.05	139.3 (8.8)	9.3	<.001
Lower-lip thickness§	9.4 (1.5)	10.1 (2.5)	0.7	>.05	11.1 (2.4)	1.7	<.001
Total lip thickness§	18.1 (2.8)	17.8 (1.5)	−0.3	>.05	19.3 (2.9)	1.2	.003
Nasal root§ (mf-mf)	18.4 (1.9)	20.2 (3.1)	1.8	>.05	21.1 (4.2)	2.7	<.001
Nasal width (al-al)	31.4 (2.0)	35.0 (4.2)	3.6	>.05	35.5 (3.4)	4.1	<.001
Alar thickness§ (al′-al′)	5.3 (0.7)	4.7 (1.3)	−0.6	>.05	4.5 (0.8)	−0.8	<.001
Columella length (c-sn)	11.5 (1.7)	8.2 (1.5)	−3.3	.001	7.5 (1.1)	−4.0	<.001
Alar length (ac-prn)	31.5 (1.8)	28.6 (3.8)	−2.9	>.05	30.1 (3.1)	−1.4	<.001
Ear incline angle, °§	17.5 (4.6)	16.7 (5.6)	−0.8	>.05	15.7 (5.3)	−1.8	.01
Nasofrontal angle, °	134.3 (7.0)	138.8 (7.4)	4.5	>.05	136.6 (6.3)	2.3	.02
Nasofacial angle, °§	29.9 (3.9)	31.7 (8.1)	1.8	>.05	32.4 (4.8)	2.5	<.001
Nasolabial angle, °	104.2 (9.8)	95.2 (2.6)	−9.0	<.001	91.7 (9.6)	−12.5	<.001

Abbreviations: ac, alar curvature point; al, alare; al′, alar rim; c, highest point of the columella; ch, cheillion; en, endocanthion; ex, exocanthion; g, glabella; gn, gnathion; mf, maxillofrontale; n, nasion; prn, pronasale; sa, superaurale; sba, subaurale; sn, subnasale; tr, trichion; v, vertex; zy, zygion.

*Unless otherwise indicated, data are mean (SD) measurements in millimeters.

†*P* values were based on unpaired *t* test with the Welch correction (the approximate *t* statistic).

‡*P* values were based on unpaired *t* test.

§Average facial feature measurements of the top 10% of Korean American women are very close in value to the norm for North American white women.

deed, in their comparative study of the neoclassical ideals and present-day North American whites, Farkas et al[2] concluded that the neoclassical canons popularized centuries ago were poor guides for determining facial beauty or norm in present North American culture.

Although minor differences in facial features exist within a specific ethnic or racial group, the overall facial structures are different across diverse ethnic and racial groups. A single facial aesthetic concept is too simple and rigid to describe the qualitative differences among different racial-ethnic facial features. Rather, several guides sensitive to the differences in facial features across different cultures are necessary. Although facial analysis in whites is widely available and much has been written on African Americans[4-7] and Latinos,[12,13] only a limited number of Asian facial analysis studies exist.[8-11] These studies have been similar in their methodologies and results, consisting of anthropometric measurements using subjects residing in Asia and comparing them with the published norms of Farkas et al.[1-3]

In our study, the traditional template for horizontal and vertical facial proportions was a poor guide to facial analysis for KA women. Only 1 subject (1%) validated the neoclassical orbitonasal canon, and 3 subjects (4%) validated the "middle third = lower third" facial canon. The racial differences revealed by this study were expected. Visually, the most influential canons contributing to the differences between the faces of the 2 races were (1) the naso-oral canon (the relationship between the mouth and nose width) and (2) the orbital and/or orbitonasal canons (intercanthal distance relative to the length of the eye fissure and/or the width of the nose). The perception is that KA women have (1) a narrow mouth/wide nose disproportion and (2) a disproportionately wide intercanthal distance. Furthermore, the KA women had a longer face (with the middle third being the longest third) than the NAW norms. Our results were similar to previous Asian facial analysis studies.[8,10] In addition to the differences in horizontal and vertical proportions, the lip was thicker and the ear was longer but less inclined in KA women. Wider nasofrontal and nasofacial angles but a more acute nasolabial angle were also seen in KA women.

Although the studies of facial features of KA women is diverse, our study adds to the existing body of literature that the neoclassical canon model is inadequate to explain different ethnic and racial facial proportions. Although the differences in the measurements compared with the published NAW norm were very small in some cases (1-2 mm), the composition of the KA woman's face is different from that of the white woman. In our study, 24 of the 26 anthropometric measurements were significantly different from the published NAW norms.[1-3]

After establishing that the anthropometric measurements of our sample of KA women did not fit the NAW norms, we categorized the subjects by facial attractiveness using a panel of KA judges. Statistical analysis showed a negative correlation between the facial measurement data and the attractiveness scale with respect to special forehead height, lower face height, interocular distance, mouth width , facial width, total lip thickness, and nasal root width but a positive correlation to nasolabial angle ($P<.05$). The analyses of ear length, lower-lip thickness, and alar length nearly achieved statistical significance ($P<.08$). When a group of subjects (n=7) in the 90th percentile for facial beauty was analyzed separately and compared with the remaining group (n=65, below the 90th percentile), none of the correlation between the facial measurements and the attractiveness scale reached statistical significance. However, ear length ($P=.06$), interocular distance ($P=.10$), and alar thickness ($P=.06$) showed statistical trends.

The facial features showing statistical trends in the most attractive group (top 10th percentile) did not necessarily reflect the same features depicted in the overall correlation between the attractiveness score and facial measurements for all KA subjects. This could be explained by the significant decrease in the number of subjects who achieved the top 10th percentile (n=7) used in the correlational analysis. We believe that if more subjects were added to the highest attractiveness group, those facial features that are truly different between the high scorers and the average scorers would become statistically significant and would mirror the overall correlation trend analysis. A composite of an attractive KA female face from our study suggests a face with narrower horizontal facial width, interocular distance, alar thickness, and nasal root; thinner lips; larger nasolabial angle; and longer lower third of the face.

Our analysis also compared the facial measurements of the high and average scorers in our KA subjects with the NAW norms to determine if any differences existed. Not surprisingly, the average facial measurement values for the KA woman's face were very different than those for the average NAW face. The Asian American face has a different skeletal profile and soft tissue thickness than the faces of whites.[14,15] In our comparison of the facial feature measurements of the high-scoring KA subjects with the average NAW women, 9 of 26 facial features were very similar (within 1-2 mm and 1°-2°) in value: nasal length, tip protrusion, lower face height, lower-lip thickness, total lip thickness, nasal root width, alar thickness, ear incline, and nasofacial angle (Table 4).

In light of these results, we must ask several questions regarding perception of facial beauty and social and cultural factors. To what degree does cultural assimilation affect one's judgment of facial attractiveness? Previous studies examining physical attractiveness have shown that aesthetic perception of face shape is similar across different cultural backgrounds.[16] What we do not know, however, is to what extent this is true. For instance, does the degree to which one is assimilated into a particular culture influence his or her aesthetic perception? The judges in part 2 of our study have lived in the United States for different lengths of time ranging from 1 month to 28 years. We did not have enough subjects in part 2 of the study to determine how length of stay in the United States would influence their overall aesthetic judgment. Living in the United States longer and having more significant exposure to the American culture might lead to assimilating some white facial features into a personal concept of facial beauty. To better study how much one has incorporated the Westernized view of facial beauty would require a study with a larger pool of judges with different lengths of stay in the United States.

Our analysis also examined the relative importance of certain facial features in the prediction of total aesthetic scoring. This model allowed us to quantify using relative percentages which facial features contributed to the overall aesthetic scores. The outcome resulted in 9 variables that could account for 46% of the aesthetic score. The facial width, nasofacial angle, and eye fissure width were the top 3 indices (Table 6). In our study, facial features from the middle of the face contributed the most to facial attractiveness. Such findings are in an agreement with a study by Kowner,[17] where a

Table 5. Comparison of Correlation Between Facial Measurements and Aesthetic Score Data in Korean American Women: Comparison Between the Top 10% and the Bottom 90%

	Total Aesthetic Scores (n = 72)			
	Bottom 90% <5.99 (n = 65)		Top 10% ≥5.99 (n = 7)	
Anthropometric Measure	r_p	*P* Value	r_p	*P* Value
Special forehead height (v-en)	−0.10	.45	−0.59	.17
Special face height (en-gn)	−0.35	.004	−0.43	.34
Forehead height 1 (tr-g)	−0.01	.97	−0.20	.67
Forehead height 2 (tr-n)	−0.17	.17	−0.21	.66
Total nasal length (n-sn)	0.01	.94	−0.29	.52
Nasal length (n-prn)	−0.00	>.99	−0.22	.64
Tip protrusion (sn-prn)	0.08	.53	−0.43	.33
Lower face height (sn-gn)	−0.33	.008	−0.15	.74
Calva height (v-tr)	−0.01	.96	−0.49	.27
Special upper face height (g-sn)	−0.28	.02	−0.32	.48
Ear length* (sa-sba)	−0.22	.08	0.73	.06
Interocular distance* (en-en)	−0.39	.001	−0.67	.10
Eye fissure width (ex-en)	0.05	.67	0.17	.71
Mouth width (ch-ch)	−0.27	.03	−0.56	.19
Facial width (zy-zy)	−0.33	.008	−0.51	.25
Lower-lip thickness	−0.19	.13	0.27	.56
Total lip thickness	−0.42	<.001	−0.43	.33
Nasal root (mf-mf)	−0.27	.03	−0.49	.26
Nasal width (al-al)	−0.14	.28	−0.63	.13
Alar thickness* (al′-al′)	0.00	.99	−0.73	.06
Columella length (c-sn)	0.00	.98	−0.47	.29
Alar length (ac-prn)	−0.19	.14	0.03	.95
Ear incline angle, °	0.07	.56	0.66	.10
Nasofrontal angle, °	−0.11	.37	−0.24	.60
Nasofacial angle, °	0.05	.72	0.49	.27
Nasolabial angle, °	0.30	.01	0.32	.48
Average measurement	−0.28	.02	−0.57	.18

Abbreviations: ac, alar curvature point; al, alare; al′, alar rim; c, highest point of the columella; ch, cheillion; en, endocanthion; ex, exocanthione; g, glabella; gn, gnathion; mf, maxillofrontale; n, nasion; prn, pronasale; r_p, Pearson correlation coefficient; sa, superaurale; sba, subaurale; sn, subnasale; tr, trichion; v, vertex; zy, zygion.
*Trends toward statistical significance.

Table 6. Regression Coefficients, Standard Error, and Uniqueness Indices of 9 Aesthetic Facial Measurements Obtained in the Final Multiple Regression Model Predicting Total Scoring

	Multiple Regression			Uniqueness Indices*	
Variable	Coefficient (SE)	*t* Value	*P* Value	Index	F Value
Intercept	9.051 (2.479)	3.651	<.001	. . .	. . .
Facial width (zy-zy)	–0.079 (0.017)	4.546	<.001	0.181	20.674
Nasofacial angle	0.089 (0.023)	3.895	<.001	0.133	15.177
Eye fissure width (ex-en)	0.213 (0.057)	3.712	<.001	0.121	13.783
Mouth width (ch-ch)	–0.088 (0.029)	3.018	.004	0.080	9.109
Alar length (ac-prn)	–0.122 (0.041)	2.955	.004	0.076	8.731
Ear length (sa-sba)	–0.059 (0.02)	2.790	.007	0.068	7.794
Special forehead height (v-en)	0.040 (0.017)	2.433	.02	0.052	5.931
Nasal length (n-prn)	0.069 (0.029)	2.359	.02	0.049	5.577
Nasal width (al-al)	0.067 (0.036)	1.887	.06	0.031	3.566

Abbreviations: ac, alar curvature point; al, alare; ch, cheillion; en, endocanthion; ex, exocanthione; g, glabella; gn, gnathion; n, nasion; prn, pronasale; sa, superaurale; sba, subaurale; zy, zygion.

*Uniqueness indices indicate the percentage of variance in total scoring accounted for by a given independent variable beyond the variance accounted for by the other 8 independent variables. F tests indicate the significance of the uniqueness indices, degrees of freedom equal to 1 and 62.

general tendency of the subjects indicated a preference among Japanese adults for narrow and small Japanese faces. Such faces seem to be associated with modernity and higher status in Japan; this may account for the 2 most common facial aesthetic procedures performed for Asian and KA women involving midfacial features (double-eyelid surgery and augmentation rhinoplasty).

In conclusion, facial analysis and proportions are important for facial plastic surgeons to assess and critique the face during the planning stages of cosmetic and reconstructive facial surgery. Thus far, many facial plastic surgeons have relied on the neoclassical cannons for facial analysis regardless of a patient's racial and ethnic background. Our study has shown that the average KA woman does not fit the neoclassical facial proportion and that significant differences exist compared with the NAW norms. The neoclassical canon model may serve as a valuable surrogate for certain present-day proportional indices of the face, but it should not be viewed as the gold standard. Although only a small number of facial features were considered marginally significant between the average and the attractive KA women in our study, increasing the number of subjects in the attractive group would strengthen those facial features that are clearly different between the attractive and the average face. Surprisingly, many of the attractive KA women's facial features reflected the facial features of the NAW women. These findings bolster the need for a broader view of facial analysis and transcultural aesthetics.

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