Expanding the Classic Facial Canons: Quantifying Intercanthal Distance in a Diverse Patient Population

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Background: The intercanthal distance (ICD) is central to our perception of facial proportions, and it varies according to gender and ethnicity. Current standardized reference values do not reflect the diversity among patients. Therefore, the authors sought to provide an evidence-based and gender/ethnicity-specific reference when evaluating patients’ ICD.

Methods: As per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, a systematic search of PubMed, Medline, and Embase was carried out for studies reporting on the ICD. Demographics, study characteristics, and ICDs were extracted from included studies. ICD values were then pooled for each ethnicity and stratified by gender. The difference between men and women, and that across ethnicities and measurement types were compared by means of independent sample t-test and one-way ANOVA (SPSS v.24).

Results: A total of 67 studies accounting for 22,638 patients and 118 ethnic cohorts were included in this pooled analysis. The most reported ethnicities were Middle Eastern (n = 6629) and Asian (n = 5473). ICD values (mm) in decreasing order were: African 38.5 ± 3.2, Asian 36.4 ± 1.6, Southeast Asian 32.8 ± 2.0, Hispanic 32.3 ± 2.0, White 31.4 ± 2.5, and Middle Eastern 31.2 ± 1.5. A statistically significant difference (P < 0.05) existed between all ethnic cohorts, between genders among most cohorts, and between most values stratified by measurement type.

Conclusions: Our standards of craniofacial anthropometry must evolve from the neoclassical canons using White values as references. The values provided in this review can aid surgeons in appreciating the gender- and ethnic-specific differences in the ICD of their patients. (Plast Reconstr Surg Glob Open 2022;10:e4268; doi: 10.1097/GOX.0000000000004268; Published online 22 April 2022.)

INTRODUCTION

Anthropometric facial measurements, first analyzed by the ancient Greeks, served as the foundation upon which the neoclassical canons were established.1,2 These canons define the ideal facial aesthetic proportions, and are continually referenced by the modern-day plastic surgeon. However, neoclassical canons do not reflect the anatomic variations attributed to age, gender, or ethnicity. With the continued trend of globalization in health-care, the patient population treated by the craniofacial surgeon has become increasingly diversified.3,4 The unique facial characteristics of different ethnicities must be accounted for to implement tailored treatment plans.

Although initially measured with modalities such as cephalography, two-dimensional photogrammetry, and direct measurement, recent technological advancements have allowed for more accurate and reliable periocular anthropometric assessment.5-7 The intercanthal distance (ICD), as defined by the distance between both medial canthi, is a central measurement of the face, and has been postulated to influence the assessment of almost all other facial morphologic variables.1,7 It has even been shown to significantly impact perceived beauty and personality.8

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The ICD should be approximately equivalent to each palpebral fissure length, allowing for a golden 1:1:1 ratio. Having objective references for this measurement is especially useful in the reconstructive setting for the proper evaluation and correction of congenital and postransitional craniofacial deformities. Specifically, restoring the ICD is paramount in the reduction of naso-orbito-ethmoidal fractures and in the correction of hypertelorism and telecanthus. It has even been postulated that the ICD can be a reliable predictor of maxillary central incisor width.

Although a multitude of studies have reported on gender- and ethnic-specific anthropometric measurements of intercanthal distance, the literature is devoid of a high level of evidence synthesis to support these claims. Therefore, the goal of this review is to provide plastic surgeons with an evidence-based and gender/ethnicity-specific reference when evaluating patients’ ICD. The authors hope this will help in providing better individualized care to patients, and to raise awareness of the role biological gender and ethnicity play in our potentially biased standards.

MATERIALS AND METHODS

A systematic search of the literature was carried out in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Guidelines. PubMed, Medline, and Embase were queried using combinations of the following search terms: “Intercanthal distance,” “Intercanthal width,” “Cephalometry [Mesh],” Anthropometry [Mesh], Face [Mesh], and Population Groups [Mesh]. The search was confined to the English language, and articles from all years were considered. Following duplicate removal, the resultant 298 articles were assessed for inclusion by two independent reviewers, according to strict inclusion and exclusion criteria (Fig. 1). Discrepancies were resolved by means of consensus. All studies describing the ICD of adults (greater than 16 years old) of a specified ethnic cohort and stratified by gender were included. Articles with fewer than 10 patients, pediatric cohorts, that did not mention exclusion of patients with prior craniofacial surgery and/or pathology, or with unspecified ethnicity, age, or gender of participants were excluded from this review. Studies included in the review were assessed for methodological quality through the National Institute of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. Demographics (age, gender, male-to-female ratio, ethnicity), study characteristics (number of patients in each cohort, method of ICD measurement used), and ICD (reported as mean ± SD in millimeters) were extracted from all included articles. Although some studies utilized different terms for the ICD (ie, intercanthal width, inner-intercanthal distance), the authors defined the intercanthal distance as the linear distance between the medial angles of the palpebral fissures, often referred to as “en-en” in terms of anthropometrics.

Studies were classified according to the following ethnic categories: African, Asian, White, Hispanic, Middle Eastern, and South/Southeast Asian.

RESULTS

Search Outcome

The search yielded 505 articles, of which 67 met the inclusion criteria. All studies received either “good” (n = 55) or “fair” (n = 14) quality assessments. Included studies represented a total of 22,638 patients and 118 ethnic cohorts (Fig. 1). These cohorts included African (n = 15), Asian (n = 22), Hispanic (n = 6), Middle Eastern (n = 21), and Southeast Asian (n = 17) participants. The majority (n = 52/67, 77.6%) of studies strictly included participants between the ages of 16 and 40, with a homogeneous distribution between men (49.8%) and women (50.2%). The largest represented cohorts consisted of Middle Eastern (n = 6629) and Asian (n = 5473) patients. ICD measurement was recorded by direct anthropometry with a caliper (n = 30), through linear dimensions on calibrated 2D photographs (n = 22), or with the use of 3D photography-based software (n = 9). Six studies did not disclose their method measurement. Demographics (ethnicity, age group, male-to-female ratio) and study characteristics (number of patients in each cohort, method of measurement used) can be found in Table 1.
Data Analysis

The overall pooled ICD was first compared by gender within the same ethnicity. A statistically significant difference was observed for all ethnicities (except Hispanic, \( P = 0.277 \)) when comparing men with women (\( P < 0.001 \)) (Table 2). The ICD was also compared between ethnicities, stratified by gender. Statistically significant differences were observed for each comparison among men (Table 3) and women (Table 4). One-way ANOVA of ICD measurement modality (direct, 2D, or 3D photography) showed statistically significant differences for all but two comparisons (Fig. 2, Table 5).

From the 15 cohorts included under the African ethnic category, the majority were either African American (\( n = 7 \)) or Nigerian (\( n = 5 \)). (See Table 1, Supplemental Digital Content 1, which displays primary studies reporting intercanthal distance for African ethnicity. http://links.lww.com/PRSGO/B998.) These yielded 1524 men with a mean ICD of 39.8 ± 2.9 mm (range: 35.7–44.4) and 1444 women with a mean ICD of 37.1 ± 2.9 mm (range: 31.4–41.8) (\( P < 0.001 \)) (Table 2). Almost all (\( n = 12/15 \)) ICD values obtained by direct measurement yielded a statistically significant difference when compared with values measured using either 2D or 3D photography (\( P < 0.001 \)). No difference was observed when comparing 2D with 3D photography (\( P = 0.627 \)) (Table 5).

From the 22 Asian cohorts, the majority were either Chinese (\( n = 13/22 \)) or Korean (\( n = 5/22 \)). (See Table 2, Supplemental Digital Content 2, which displays primary studies reporting intercanthal distance for Asian ethnicity. http://links.lww.com/PRSGO/B999.) These yielded 2447 men with a mean ICD of 37.1 ± 1.8 mm (range: 33.4–44.9) and 3026 women with a mean ICD of 35.9 ± 1.3 mm (range: 32.0–41.9) (\( P < 0.001 \)) (Table 2). Image-based measurements resulted in the highest pooled averages. A statistically significant difference was observed when comparing the three methods of measurements (\( P < 0.001 \)) (Table 5).

Of the 37 White cohorts, participants were almost exclusively (\( n = 32/37 \)) of European origin, and most commonly (\( n = 11/37 \)) Italian. (See Table 3, Supplemental Digital Content 3, which displays primary studies reporting intercanthal distance for White ethnicity. http://links.lww.com/PRSGO/B1000.) These resulted in 2375 men with a mean ICD of 31.9 ± 2.2 mm (range: 27.8–42.9) and 1525 women with a mean ICD of 30.7 ± 2.6 mm (range: 27.4–39.3) (\( P < 0.001 \)) (Table 2). Similar to the Asian...
### Table 1. Included Articles in the Meta-analysis and Their Corresponding Demographic Information

| Author | Ethnicity | Population (N) | Age (y), Mean ± SD (Range) | Male: Female Ratio | Method of Measurement |
|--------|-----------|----------------|-----------------------------|--------------------|-----------------------|
| Abdullah | Middle Eastern | 229 | 21.46 (19-24) | 1.1:1 | Direct anthropometry, manual caliper |
| Al-Jassim et al | Middle Eastern | 759 (3 different cohorts) | >18 | 1.06:10.71:1 | Direct anthropometry, manual caliper |
| Al-Qattan et al | Middle Eastern | 132 | 109 | 0.35:1 | Direct anthropometry, digital caliper |
| Al-Sebaei | Middle Eastern | 759 | 132 | 109 | Calibrated photographs, linear dimensions using photograph software (Adobe Photoshop CS4) |
| Al-Wazzan | Middle Eastern | 100 | 23.7 ± 3.4 (18-30) | 1:1 | Direct anthropometry, digital caliper |
| Amra et al | Middle Eastern | 96 | 48.69 ± 12.31 | 2:1 | Calibrated photographs, linear dimensions using photograph software (Image J) |
| Banu et al | Southeast Asian | 120 (20-30) | 1:1 | Direct anthropometry, manual caliper |
| Baretto and Mathog | African, White | 6165 | — | 1.18:11.09:1 | Direct anthropometry, ruler |
| Bornan et al | Middle Eastern | 1050 | (20-30) | 1:1 | Direct anthropometry |
| Bokir et al | Middle Eastern | 500 (18-25) | 0.84:1 | Direct anthropometry, millimetric compass |
| Bukhari et al | Middle Eastern | 668 | 33.8 (15-75) | 0.7:1 | Direct anthropometry, linear dimensions |
| Celebi et al | Hispanic (2 different cohorts) | 131 (18-30) | 0.93:10.92:1 | 3D landmarks, three-dimensional computerized electromagnetic digitizer (3dMD face system) |
| Charles et al | African | 435 (22-40) | 1.35:1 | Direct anthropometry, manual caliper |
| Choe et al | Asian | 72 | 25 (18-35) | — | Not specified |
| Dong et al | Asian | 289 | Men: 22-29 Women: 20-31 | 1.02:1 | 3D stereo photogrammetry (3DSS-II) |
| Egwu et al | African | 460 | 22.46 ± 3.34 | 1.35:1 | Direct anthropometry, plastic ruler |
| Evereklioglu et al | Middle Eastern | 1103 | (16-25) | 1.12:11.23:1 | Direct anthropometry, plastic ruler |
| Fariaby et al | Middle Eastern | 100 | 20 | 1:1 | Calibrated photographs, linear dimensions using photograph software |
| Farkas et al | African, White, Middle Eastern, Asian, Southeast Asian | 360 (18-30) | 1:1 | Direct anthropometry, manual caliper |
| Ferrario et al | White | 79 | Young adults: 23 (18-30) | 1.22:1 | 3D landmarks, three-dimensional computerized electromagnetic digitizer (3 Draw) |
| Freihofner | White | 100 | 42 | 1.13:1 | Not specified |
| He et al | Asian | 119 | 22.7 (18-25) | 0.89:1 | Direct anthropometry, digital caliper + calibrated photographs, angles using photograph software (Image-Pro Plus 5.0) |
| Hussein et al | Southeast Asian | 102 (18-30) | 0.98:1 | 3D landmarks, three-dimensional computerized electromagnetic digitizer (3 Draw) |
| Jayaratne et al | Asian | 103 (18-35) | — | Calibrated photographs, linear dimensions using photograph software (Image-Pro Plus 5.0) |
| Kim et al | Asian | 2065 | 21.6 (18-29) | 1.2:1 | Not specified |
| Kim et al | Asian | 199 | Parents: 55.2 ± 13.9 Offspring: 36.0 ± 17.4 | 0.66:1 | Calibrated photographs, linear dimensions using photograph software (Image-Pro Plus 5.0) |
| Kim et al | Asian | 4348 | Pageant: 22.3 ± 3 Normal: 25 ± 5 | — | 3D photography (Morpheus) |
| Kunjur et al | Asian, White, Southeast Asian | 78 | 1:1 (each) | Calibrated photographs, linear dimensions |
| Laestadius et al | White | 50 | >19 | 1:1 | Direct anthropometry, manual caliper |
| Leong and White | White | 5450 | (17-24) | 0.8:1 | Calibrated photographs, linear dimensions using photograph software (Adobe Photoshop) |
| Li et al | Asian | 900 (18-55) | 1.08:1 | 0.92:1 | Direct anthropometry, manual caliper |
| Li et al | Asian | 162 | 25 (20-30) | 0.95:1 | Calibrated photographs, linear dimensions using photograph software (Adobe Photoshop) |
| Liu et al | Asian, African | 72 (18-30) | 0.8:1 | 0.95:1 | 3D landmarks, three-dimensional computerized electromagnetic digitizer (3dMD face system) |
| Lu et al | Asian, Southeast Asian | 97 (20-39) | 1.02:1 | 0.81:1 | 3D landmarks, three-dimensional computerized electromagnetic digitizer (VECTRA) |
| Mehta et al | Southeast Asian | 1000 | 35.1 | 1:1 | Not specified |
| Milgrim et al | Hispanic | 37 | 37.5 (25-56) | — | Not specified |

(Continued)
cohort, image-based measurements resulted in the highest pooled ICD averages (Table 5). Statistically significant differences were observed between the three measurement methods ($P < 0.001$).

The Hispanic ethnicity was the least represented among cohorts (n = 6), with half of the patients from South America. (See table 4, Supplemental Digital Content 4, which displays primary studies reporting intercanthal distance for Hispanic ethnicity. http://links.lww.com/PRSGO/C2.)

These yielded 170 men with a mean ICD of $32.4 \pm 2.4$ mm (range: 29.3–35.1) and 276 women with a mean ICD of $32.2 \pm 1.7$ mm (range: 29.6–34.1) ($P < 0.001$) (Table 2). The majority (n = 4/6) of studies did not specify which measurement type was used, rendering statistical analysis unfeasible (Table 5).

Middle Eastern ethnicity accounted for 21 cohorts, with Turkish (n = 7/21) and Iranian (n = 6/21) being the most prevalent. (See table 5, Supplemental Digital Content 5, which displays primary studies reporting intercanthal distance for Middle Eastern ethnicity. http://links.lww.com/PRSGO/C3.)

These yielded 3243 men with a mean ICD of $31.5 \pm 1.7$ mm (range: 27.3–41.1) and 3386 women with a mean ICD of $30.9 \pm 1.3$ mm (range: 24.6–39.3) ($P < 0.001$) (Table 2). Statistically significant differences were observed for all measurement types ($P < 0.001$), except for direct versus 2D images ($P = 0.361$) (Table 5).

Finally, 17 Southeast Asian cohorts were included, with the majority being of Malaysian (n = 7) or Indian (n = 7) origin. (See table 6, Supplemental Digital Content 6, which displays primary studies reporting intercanthal
These accounted for 1493 men with a mean ICD of 33.0 ± 2.2 mm (range: 30.1–37.2) and 1729 women with a mean ICD of 32.7 ± 1.8 mm (range: 29.8–36.2) (P < 0.001) (Table 2). Similarly, a comparison of the three types of measurements used to obtain ICDs yielded statistically significant differences (P < 0.001) (Table 5).

**DISCUSSION**

This review represents the largest evidence-based analysis of intercanthal distances to date. The results of this pooled analysis demonstrate that the ICD varies significantly across different ethnicities and genders. Plastic surgeons should be aware of this when evaluating their patients’ intercanthal distance and can now refer to the values presented in this review as a reference. Patients from African or Asian backgrounds had higher ICD values than their counterparts, and men had higher ICD values than women across ethnicities. This review also highlights the confounding role that the type of measurement used can play in the reporting of the ICD.

In the largest multicentric study on anthropometric measurements by Farkas et al.,1 the Middle Eastern cohort showed similar values for ICD when compared with North American White patients, as also demonstrated in our pooled analysis. However, although Farkas et al.1 claimed that African and Asian patients had similar ICDs when compared with North American White patients, our results show they are in fact significantly larger. As shown in our analysis, this might be attributed to the variability between different anthropometric measurement methods. When attempting to mitigate this possible bias by solely using values obtained by direct anthropometry, as done by Farkas et al.,1 the African and Asian cohorts in our review still have clearly higher values for the ICD than their White counterparts (Table 5). Furthermore, our study analyzed Asian and Southeast Asian patients separately. Because our data demonstrate that the Southeast Asian cohort had significantly lower values than their Asian counterparts, the fact that Farkas et al.1 pooled these may explain why they found lower values for their Asian cohort. In fact, many studies have found discrepancies with the values reported by Farkas et al.1 and their own findings,58 which highlight the need for a meta-analysis of the ICD, and the importance of taking into account each values’ respective SD and the ranges provided.

According to our data, men consistently had larger ICDs than women across all ethnicities. Despite this largely being known, this pooled analysis now confers greater power to this conclusion and provides gender- and ethnic-specific references. This may even have important implications for the growing field of facial feminization surgery.53,78,79 It is worth highlighting that the authors pooled all participants regardless of adult age, with 77.6% of studies providing patients between the ages of 16 and 40. Although one might think age may play an important role in anthropometric proportions, the literature suggests that the ICD stabilizes as the craniofacial skeleton matures (at the latest around 16 years of age), and that no real difference arises throughout adulthood until

**Table 2. Pooled Intercanthal Distances among All Ethnicities and Stratified according to Gender, and the Results of Statistical Analysis Comparing Differences between Men and Women**

| Ethnicity     | No. Patients | Mean (mm) ± SD | P   |
|---------------|--------------|----------------|-----|
| African       | 2968         | 38.5 ± 3.2     |     |
| Men           | 1524         | 39.8 ± 2.9     | <0.001 |
| Women         | 1444         | 37.1 ± 2.9     |     |
| Asian         | 5473         | 36.4 ± 1.6     |     |
| Men           | 2447         | 37.1 ± 1.8     | <0.001 |
| Women         | 3026         | 35.9 ± 1.3     |     |
| White         | 3900         | 31.4 ± 2.5     |     |
| Men           | 2375         | 31.9 ± 2.2     | <0.001 |
| Women         | 1525         | 30.7 ± 2.6     |     |
| Hispanic      | 446          | 32.3 ± 2.0     |     |
| Men           | 170          | 32.4 ± 2.4     | 0.277 |
| Women         | 276          | 32.2 ± 1.7     |     |
| Middle Eastern| 6629         | 31.2 ± 1.5     |     |
| Men           | 3243         | 31.5 ± 1.7     | <0.001 |
| Women         | 3386         | 30.9 ± 1.3     |     |
| Southeast Asian| 3222       | 32.8 ± 2.0     |     |
| Men           | 1493         | 33.0 ± 2.2     | <0.001 |
| Women         | 1729         | 32.7 ± 1.8     |     |

**Table 3. Statistical ANOVA Analysis Comparing Mean Intercanthal Distances of Men across Different Ethnicities**

| Ethnicity       | African | Asian | White | Hispanic | Middle Eastern | Southeast Asian |
|-----------------|--------|-------|-------|----------|----------------|-----------------|
| African         | —      | <0.001| <0.001| <0.001   | <0.001         | <0.001          |
| Asian           | <0.001| —     | <0.001| <0.001   | <0.001         | <0.001          |
| White           | <0.001| <0.001| —     | 0.01     | <0.001         | <0.001          |
| Hispanic        | <0.001| <0.001| 0.011 | —        | <0.001         | 0.002           |
| Middle Eastern  | <0.001| <0.001| <0.001| <0.001   | —              | <0.001          |
| Southeast Asian | <0.001| <0.001| 0.002 | <0.001   | —              | —               |

**Table 4. Statistical ANOVA Analysis Comparing Mean Intercanthal Distances of Women across Different Ethnicities**

| Ethnicity       | African | Asian | White | Hispanic | Middle Eastern | Southeast Asian |
|-----------------|--------|-------|-------|----------|----------------|-----------------|
| African         | —      | <0.001| <0.001| <0.001   | <0.001         | <0.001          |
| Asian           | <0.001| —     | <0.001| <0.001   | <0.001         | <0.001          |
| White           | <0.001| <0.001| —     | <0.001   | <0.001         | <0.001          |
| Hispanic        | <0.001| <0.001| <0.001| —        | <0.001         | <0.001          |
| Middle Eastern  | <0.001| <0.001| 0.019 | <0.001   | <0.001         | <0.001          |
| Southeast Asian | <0.001| <0.001| <0.001| <0.001   | <0.001         | —               |
Following rapid growth within the first two years of life, orbital parameters reach greater than 86% of adult size by the age of 8 years.\(^{83}\)

It is also important to emphasize that when stratifying by measurement type, almost all values showed significant differences. Measurement type was thus a major confounding factor in our analysis. No trends as to which measurement method yielded the highest or lowest values could be identified. However, image-based measurements were most often (n = 5/10 cohorts compared) the highest in their respective gender-specific category, and 3D-based measurements were most often (n = 5/10 cohorts compared) the lowest (Table 5). Many previous studies have investigated the reliability of 2D and 3D imaging techniques in relation to direct anthropometry, as well as in relation to each other.\(^{84-88}\) Nonetheless, results regarding differences between techniques are mixed, likely a reflection of the instrument bias inherent to anthropometric studies. Adding measurement type as another layer of classification between studies clearly highlights its role as a confounder, which is why the authors found providing such values (Table 5) to be of utmost importance. Although we were not able to control for such in our analysis, these results make it clear that a standardized reporting method is the key to precise anthropometrics. Given the mixed opinions regarding which technique is the best, authors should strive to report their results in at least two ways, which would pave the way to better assess the effect of measurement methods in future reviews.

Within the modern scope of plastic surgery, the ICD, similarly to other facial metrics, is more often than not useful as a proportion rather than as a stand-alone measure. For example, the balance between the ICD and alar base width is often relied upon for both aesthetic and reconstructive facial assessments, and the ICD relative to cranio-orbital morphology in the context of hypertelorism is usually most indicative. Nonetheless, a study of

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**Table 5. Comparison of Three Measurement Methods of ICD between Genders and Ethnicities**

| Ethnicity                | Mean ICD (mm) | Direct | 2D Image | 3D Image | P     |
|-------------------------|---------------|--------|----------|----------|-------|
| African                 |               |        |          |          |       |
| Men                     | 39.8          | 44.4   | 36.5     | <0.001   |       |
| Women                   | 37.5          | 34.7*  | 34.4*    | <0.001   |       |
| Asian                   |               |        |          |          |       |
| Men                     | 36.4          | 37.9   | 35.7     | <0.001   |       |
| Women                   | 35.2          | 36.5   | 35.5     | <0.001   |       |
| White                   |               |        |          |          |       |
| Men                     | 31.5          | 34.5   | 22.0     | <0.001   |       |
| Women                   | 30.0          | 33.2   | 31.4     | <0.001   |       |
| Hispanic                |               |        |          |          |       |
| Men                     | N/A           | N/A    | 31.5     | N/A      |       |
| Women                   | N/A           | N/A    | 31.7     | N/A      |       |
| Middle Eastern          |               |        |          |          |       |
| Men                     | 31.6†         | 31.5†  | 31.8     | 0.479    |       |
| Women                   | 31.0          | 30.7   | 30.9     | <0.001   |       |
| South/Southeast Asian   |               |        |          |          |       |
| Men                     | 34.6          | 32.3   | 31.1     | <0.001   |       |
| Women                   | 33.8          | 32.4   | 30.2     | <0.001   |       |

*Denotes a nonsignificant difference when comparing 2D with 3D measurement modalities in African women.

†Denotes a nonsignificant difference when comparing direct with 2D measurements in Middle Eastern men.
proportions is beyond the scope of this review. To be able to study proportions, individual craniofacial landmarks must first be thoroughly assessed, hence the intrinsic worth of this review.

Limitations and Future Directions

This review is not without its limitations. Firstly, although the authors could not completely eliminate the confounding effect of measurement methods, the presentation of measurement-specific values serves to somewhat mitigate this. When taking a closer look at our data, there were no clear trends as to which method yielded higher or lower values. This has important implications moving forward, as surgeons should be mindful of this bias when reporting their results and should strive to devise a standardized reporting method for anthropometric measurements. Secondly, this review demonstrates the clear paucity of data regarding the Hispanic ethnicity, which may have underpowered this specific analysis. Considering this ethnic group now represents almost 20% of the US population, the literature is in dire need of a more comprehensive report of anthropometric measurements for this cohort. Furthermore, publishing bias from developing nations or governmentally unstable regions may result in the underrepresentation of certain demographics in the included studies due to economic, political, or governmental limitations. It is worth mentioning that some studies included cohorts from beauty pageant contestants, which may have introduced a small pre-selection bias in our analyses. Finally, although some might argue that pooling different populations from the same ethnicity can lead to unrepresentative results, this was done to facilitate reporting for the purpose of this pooled analysis. Nevertheless, readers may refer to the Supplemental Digital Content should they desire ICD values reported in a population-specific manner, as reported in each of the primary studies. Although a reflection of the primary source data, it is also important to stress that there is no universal consensus as to the exact classification between ethnic categories. In addition, given the high worldwide migratory trends in the last 50 years, these classifications are less clearly defined. Nonetheless, this has been mitigated by relying on classifications set forth by the National Institute of Health and the United Nations, although even these are conflicting with each other. Agreed upon standards should be developed regarding this endeavor. Given the heterogeneity among studies related to measurement methods and populational pooling, a formal meta-analysis was not possible. Therefore, the continuous nature of the studied data was best compared through weighted means, among which heterogeneity was mitigated through formal assessment of included studies.

CONCLUSIONS

With the ever-increasing diversity of their treated patient populations, plastic surgeons should strive to tailor their facial reconstructive goals based on ethnicity/race. This is especially true for the ICD, as it may be a potential determinant of facial aesthetic harmony. This pooled analysis provides an evidence-based and gender/ethnicity-specific reference for the ICD. Rather than using White measurements as the aesthetic ideal and comparator, health professionals can now rely on gender- and ethnic-specific standards to guide their preoperative planning and postoperative assessment of results. This is especially true for patients from Asian/African descent, who may have larger ICDs than their counterparts. Surgeons should also be cognizant of the confounding role that the type of measurement used can play in the reporting of the ICD. We hope that this article encourages awareness of the range of facial aesthetic standards that exist and fosters better individualized patient care.

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