A Multicenter Interracial Study of Facial Appearance. Part 1: A Comparison of Extraoral Parameters

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Purpose: This study was undertaken to compare the facial appearance of patients from six racial groups (African American, Caucasian, Chinese, Hispanic, Japanese, and Korean) for interracial and/or gender differences and to determine if "norms" existed. **Materials and Methods:** A total of 253 subjects (144 men and 109 women) ranging in age from 18 to 41 years (mean age 26.5 years) were evaluated using a standardized protocol. The data were collected and analyzed to establish reference ranges for seven frontal and six profile extraoral parameters. Mean scores were compared by race and gender using a one-way analysis of variance, followed by the Tukey-Kramer test for honestly significant difference when statistically significant differences were found ($P < .05$). **Results:** There were no significant differences for any of the seven frontal or six profile extraoral parameters between men and women. No significant differences were found between racial groups for five of the seven frontal and one of the six profile extraoral parameters. **Conclusion:** Most of the frontal facial parameters and one profile extraoral parameter might be considered norms for male and female patients of different ethnic origins. Additional research with larger patient populations would be needed to confirm or refute these trends. *Int J Prosthodont 2002;15:273–282.*

Driven by increased interest within dentistry and greater patient awareness outside the profession, facial esthetics and the desire of patients to improve their appearance have grown in importance.[1–3] Rather than concentrate on one aspect, such as a smile analysis,[4–8] interest in the overall facial appearance has increased in contemporary prosthodontic treatment.[2,3,8–12] In 1984, Albino et al[13] anticipated that esthetic considerations would become a major concern for patients seeking prosthodontic services in the future. The subsequent revolution in cosmetic dental materials and techniques and the explosive growth in esthetic dentistry support that view. The dental profession has even seen greater emphasis on esthetic communication[14,15] for improved diagnosis and treatment planning with the use of attractiveness/self-image satisfaction scales intended to enhance esthetic outcomes.[16,17]

Traditionally, prosthodontists have been taught to evaluate facial esthetics from both the frontal and lateral views to restore overall harmony to the face.[10,18] Clinicians are encouraged to create or restore a pleasant facial appearance by developing a balanced and pleasant smile[7,19,20] and restoring an acceptable vertical dimension of occlusion.[10,12,18,21] Prosthodontists, and many patients alike,[22] often focus on key frontal esthetic parameters, and certain esthetic canons establish a link between eye-tooth relationships.[1,23,24]

It is also important to assess a patient's facial profile by evaluating both the anteroposterior and vertical

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Table 1 University Centers Used and Races Evaluated

Location	Race	Subjects	Men	Women
Indiana University School of Dentistry, Indianapolis	African American	44	21	23
	Caucasian	42	22	20
Kyungpook National University, Taegu, Korea	Korean	43	30	13
Kyushu Dental College, Kitakyushu, Japan	Japanese	44	29	15
National University of Singapore	Chinese	40	24	16
University of Puerto Rico, San Juan	Hispanic	40	18	22

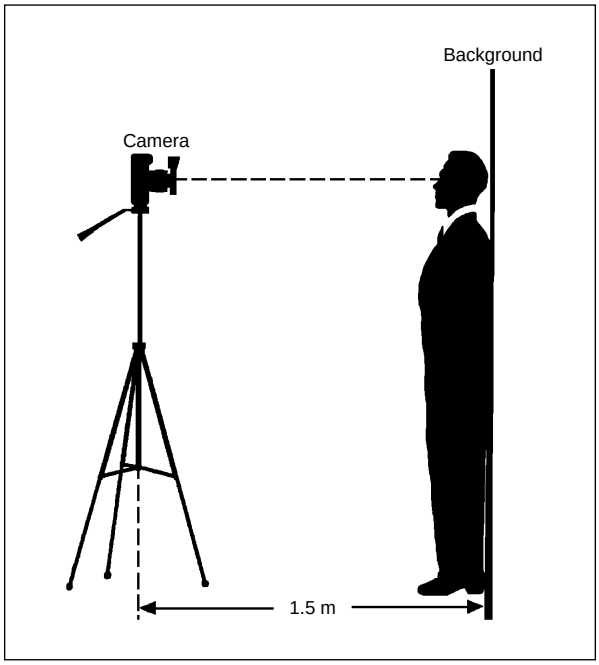

Fig 1 Standardized photographic setup of subject and camera.

parameters of the face. Surprisingly, the majority of this type of information for dentate subjects emerged from the orthodontic literature rather than from prosthodontic research. Orthodontic treatment creates or restores optimal dentolabial relations[25] given that teeth provide lip support and maintain lip contours in harmony with other facial features. In prosthodontics, treatment objectives are essentially the same. Clinicians strive to change the anteroposterior and vertical components of facial relationships to compensate for traumatic bone loss, the effects of aging, loss of support from periodontal disease, tooth loss, or other similar conditions.

As to the question of how to address the restoration of facial appearance, several authors have discussed racial variations among these facial parameters.[13,18,26–29] In 1992, Johnson[29] reported how knowledge of racial "norms" for facial appearance might aid practitioners. He felt an understanding of these norms would lead to better esthetics and treatment plans, because the treatment rendered would then be in harmony with the facial appearance for patients of different races. Some 12 years earlier, Richardson[27] published his view that the components of the face closer to the alveolar and dental areas are responsible for the greatest differences among races. If correct, such a belief points to the need for a careful evaluation of the esthetic parameters of the face for comparisons among patients.

The purpose of this study was to compare the facial appearance of patients from six races to determine how similar or different the components of facial appearance are for people of different ethnic origins.

Materials and Methods

The sample population consisted of 253 subjects (144 men and 109 women) of six races from five centers located throughout the world (Table 1). The number and race of the subjects were categorized at each center: 44 African Americans, 42 Caucasians, 43 Koreans, 44 Japanese, 40 Chinese, and 40 Hispanics. Each subject's medical history provided data on age, gender, racial origin, and geographic location. No patients of known mixed racial origin were selected. The subjects had a mean age of 26.5 years (range 18 to 41 years). The exclusion criteria eliminated subjects with a history of trauma, congenital or acquired defects in the head and neck region, loss or prosthetic replacement of anterior teeth, and a history of orthodontic treatment or maxillofacial surgery.

Color photographs of each patient were taken from two frontal views (at rest and at maximum smiling position) and one profile view (at rest). A standardized photographic protocol was created and used at each center (Fig 1). The protocol was a modification of previously described methods.[30,31] The photographic equipment included a 35-mm camera body with a

Fig 2 Representative photographs of a subject in front view with a maximum smile and profile view.

Table 2 Anatomic Landmarks for the Extraoral Profile Analysis

Point	Landmark
1 and 2	Any two points on the vertical ruler
3	The frontal point, the most prominent point of the forehead
4	The soft tissue nasion, the deepest concavity of the bridge of the nose
5	The point at which the tangent from the soft tissue chin touches the nose
6	The point at which the tangent from the soft tissue subnasal touches the base of the columella
7	The soft tissue subnasal, the turning point between the base of the columella and the upper lip
8	The vermillion border of the upper lip in the midsagittal plane
9	The vermillion border of the lower lip in the midsagittal plane
10	The inferior labial sulcus, the point of greatest concavity in the midline of the lower lip
11	The soft tissue chin, the point touching the tangent from the lower lip vermillion border to the chin

105-mm lens and a point flash mounted in the 12 o'clock position. The camera aperture setting was f8, and only ASA 100 Ektacolor print film (Eastman Kodak) was used. A meter ruler was mounted perpendicular to the floor in the background to the left of the patient's head (Fig 2). All five international centers received an instructional videotape depicting the photographic setup and the protocol for taking the three facial photographs. The exposed film was collected and sent to the Eastman Kodak Company for processing.

The photographs were analyzed in both the frontal and lateral views. Certain anatomic and vertical plane landmarks were marked on the profile photographs of each subject (Table 2 and Fig 3) and transferred to acetate film at the exact location of the specific landmark using a previously described method.[31] In addition, specific points were located on the nonsmiling and maximal smiling frontal photographs (Table 3 and Figs 4 to 6). These points were transferred to

Fig 3 Anatomic landmarks used for the profile tracing (Table 2).

Table 3 Anatomic Landmarks for the Extraoral Frontal Analysis

Point	Landmark
1 and 2	The center of the pupil of the left and right eyes, respectively
3 and 4	Left and right soft tissue orbitale, respectively, defined as those points on the lower margins of the orbits that are directly below the pupil when the eye is open and the patient looks straight ahead
5 and 6	Left and right commissures of the mouth, respectively
7	The midpoint on a line between the left and right pupils
8 and 9	The most coronal points on the incisal edges of the left and right maxillary central incisors, respectively
10 and 11	The tips of the left and right maxillary canines, respectively

acetate film, where lines were drawn between the points to permit analysis of changes occurring between the nonsmiling and smiling views. Seven frontal parameters and six profile parameters were measured using these points and lines. A calibrated digitizing tablet and digitizer (Jandel Scientific) recorded the specific landmarks and transferred the data to a computer (IBM PC). All linear and angular measurements were derived from these coordinates using analytical software (Sigma-Scan, Calibration File Converter, version 3.90, Jandel Scientific). Measurements were made by a single investigator in the United States.

Frontal Extraoral Parameters

Seven extraoral parameters were compared using the traced anatomic landmarks (Figs 4 to 6). The first five frontal parameters were analyzed for their parallelism to the horizontal interpupillary line (Fig 4). The measurements were recorded as a positive value in degrees if the slope was upward from right to left, or as a negative value if the slope was upward from left to right as follows:

1. Relative parallelism of the interpupillary line (A) to the transverse line joining the left and right orbitale landmarks in the rest position (B), measured in degrees and referred to as IPO (Fig 4).
2. Relative parallelism of the interpupillary line to a line through both commissures at rest (C in Fig 4), measured in degrees and referred to as IPCLR.
3. Relative parallelism of the interpupillary line to the commissure line in the maximum smile position (Fig 4), measured in degrees and referred to as IPCLMS.
4. Relative parallelism of the interpupillary line to the cant of the maxillary frontal occlusal plane in the maximum smile position, line D (Fig 4). The maxillary frontal occlusal plane was measured in degrees relative to a line joining the most coronal points of the incisal edges of the maxillary central incisors and referred to as IPMFO.
5. Relative parallelism of the interpupillary line to a line joining the incisal edge of the left and right maxillary canines (line A in Fig 5 and line F in Fig 6), measured in degrees and referred to as IPLRCT.

The remaining two extraoral parameters were analyzed using the maxillary anterior teeth as follows:

6. Midline position (E) of the maxillary incisors (MIDMI) relative to a perpendicular line (A) bisecting the interpupillary line (Fig 4). The midline was recorded as coincident with the perpendicular line or deviated to either the left or right. A recording of 0 indicated coincidence, a value of 1 indicated deviation to the left, and a value of 2 indicated deviation to the right.
7. The parallelism of the maxillary anterior teeth smile line (MASLLL), represented by a curved line (G) following the incisal edges and canine cusp tips, compared to the curved superior border of the lower lip (Fig 6). A value of 1 indicated parallelism, and a value of 0 indicated no parallelism.

Profile Extraoral Analysis

Six parameters were compared using the profile anatomic landmarks in the tracings (Fig 3). The first four were obtained by measuring the angles (in degrees) formed by lines connecting specific anatomic landmarks. The last two parameters examined in this analysis reflected the relationship of both the upper and the lower lip to a line from the end of the nose to the chin. This line is known as Ricketts's Esthetic Plane.[32] When either lip was anterior to Ricketts's plane, a positive value was recorded, and when a lip was posterior to the line the value was negative. The six profile parameters (Table 2 and Fig 3) were:

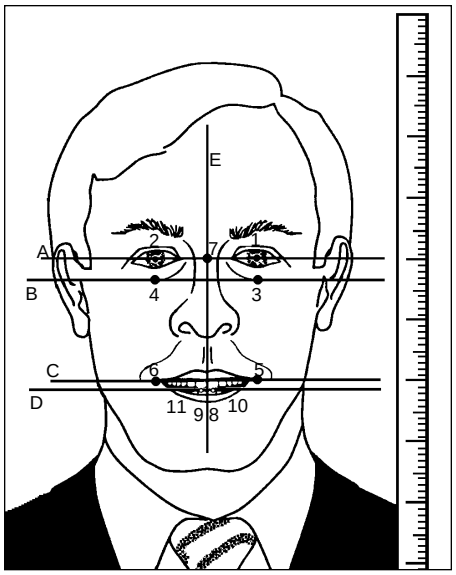

Fig 4 Lines A, B, C, D, and E and their corresponding anatomic landmarks in the maximum smiling subject (Table 3).

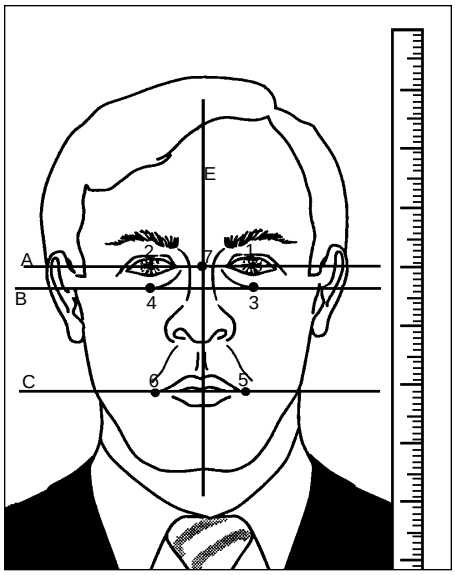

Fig 5 Lines A, B, C, and E and their corresponding anatomic landmarks in the nonsmiling subject (Table 3).

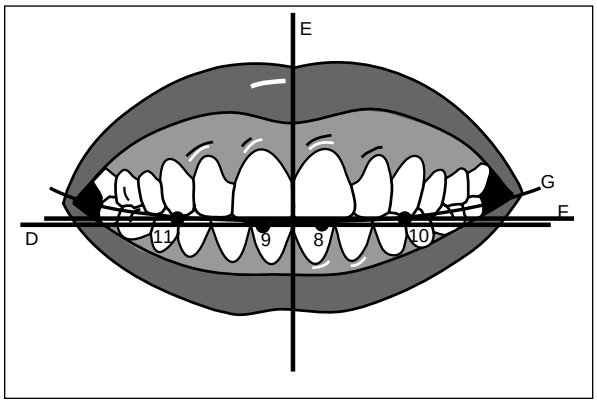

Fig 6 Lines, D, E, F, and G and their respective anatomic landmarks in the maximum smiling subject (Table 3).

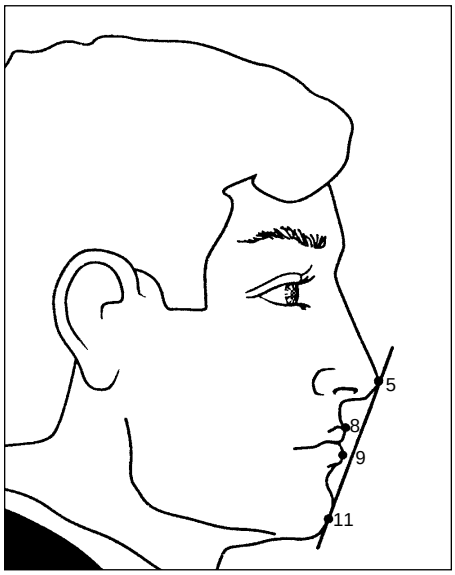

Fig 7 *(right)* Linear relationship between Ricketts's Esthetic Plane and the lips, as well as the anatomic landmarks from which the plane was derived (Table 2).

1. Profile convexity (PC) was the angle defined by the landmarks 4, 7, and 11.
2. Interlabial contour (ILC) was the angle formed by the landmarks 7, 8, 9, and 10.
3. Nasolabial angle (NLA) was the angle formed by the landmarks 6, 7, and 8.
4. Mentolabial angle (MLA) was the angle formed by the landmarks 9, 10, and 11.
5. Upper lip relative to Ricketts's Esthetic Plane (ULEP), as seen in Fig 7, point 8.
6. Lower lip relative to Ricketts's Esthetic Plane (LLEP), as seen in Fig 7, point 9.

Statistical Analysis

The statistical analysis focused on establishing reference ranges for the seven frontal and six profile parameters using data collected from all 253 subjects. Ninety-five percent confidence intervals about the mean for each of the esthetic parameters were constructed for each of the six racial groups and both genders. The effects of racial origin were tested by fitting a general linear model to the data. After the mean scores for race and gender were calculated by category, a one-way analysis of variance (ANOVA)

Table 4 Photographic Reproducibility Statistics

Demographic category	Mean (n = 20)	Standard deviation	*t* test prob > |*t*|*
PC	–0.1	2.1	.8
ILC	0.2	6.7	.9
NLA	–3.3	6.7	.5
MLA	3.1	15.2	.4
ULEP	0.2	0.5	.8
LLEP	0.3	1.2	.2
IPO	–0.1	1.4	.8
IPCLR	0.0	1.8	1.0
IPCLMS	–0.4	1.7	.1
IPMFO	–0.4	2.9	.6
IPLRCT	0.6	1.6	.1
MIDMI	0.1	0.6	.7
MASLLL	–0.1	0.4	.6

*$P < .05$ indicates a statistically significant difference.

was used to determine significant differences between groups using the SAS statistical package (SAS Institute) for all analyses. The Tukey-Kramer test for honestly significant difference compared means for each pair of racial or gender groups where statistically significant differences were found ($P < .05$).

Results

Reproducibility

The reproducibility of the photographic data analysis was confirmed by comparing measurements of 20 randomly selected patients taken 2 months apart. No statistically significant differences were found in the measurements, except for NLA, which was significantly different among races ($P < .05$) and not reproducible (Table 4).

Frontal Extraoral Parameters

There were no statistically significant racial or gender differences for the seven frontal extraoral parameters (Table 5). The first five parameters were analyzed to establish their parallelism to the horizontal interpupillary line (IPO, IPCLR, IPCLMS, IPMFO, and IPLRCT). The overall mean values were positive, suggesting a slight upward inclination from the subjects' right to left sides.

The remaining two parameters assessed the midline and the anterior smile line. Analysis of the midline parameter indicated that Caucasians, African Americans, and Chinese had the highest frequency of midline coincidence with the line drawn perpendicular to the interpupillary line (79%, 76%, and 75%, respectively). Overall, the midline of 22% of patients deviated to the left and 8% deviated to the right, with 70% of all patients having midlines coincident with the line perpendicular to the interpupillary line. Hispanics had the least amount of midline coincidence (59%), while Caucasians had the highest level of coincidence (79%).

The greatest degree of parallelism of MASLLL was found among the Koreans (81%), and the least amount (68%) was recorded for the Japanese. Overall, 74% of all subjects, male and female, had parallelism of MASLLL with the inner border of the lower lip. No statistically significant differences were found based on either race or gender (Table 5).

Profile Extraoral Parameters

Five of the six profile extraoral parameters (PC, ILC, NLA, ULEP, and LLEP) had significant interracial variation ($P < .001$), but none of the six parameters exhibited statistically significant gender differences ($P > .05$; Table 6).

The PC for all races had an overall mean of 164 degrees, and significant interracial differences were noted ($P = .001$). Koreans had the least convex facial profile (168 degrees), and this outcome was significantly less than all the other races. African Americans had the most convex profiles (162 degrees), but were not significantly different from Hispanics (163 degrees), Caucasians (164 degrees), and Japanese (165 degrees).

The overall mean ILC was 128 degrees, and significant interracial differences were found ($P = .001$). The angle between the upper and lower lips was significantly more obtuse for Caucasians (144 degrees) than for the other races. African Americans had the most acute interlabial angle (111 degrees), which was statistically similar to the Chinese (115 degrees). The three Asian races (Chinese, Japanese, and Korean) were all statistically similar.

The NLA had an overall mean value of 98 degrees, and significant interracial variations ($P = .001$) were noted. Caucasians (110 degrees) and Hispanics (105 degrees) had the largest angles but were not significantly different from one another. The Koreans (93 degrees), Chinese (92 degrees), and African Americans (90 degrees) had lower values and were not statistically different from one another, but they were statistically different from the Caucasians and Hispanics. Gender differences were evident but were not statistically significant. The overall mean MLA was 139 degrees, with no statistically significant interracial or gender differences.

The mean distance of ULEP ranged from +0.3 mm for the African Americans to –7.5 mm for the Caucasians. The African Americans had the only

Table 5 Summary Statistics for Frontal Extraoral Parameters*

Parameter	n	Mean	SD	*P* value
IPO (degrees)				
African American	44	0.5	1.6	
Caucasian	42	0.6	1.7	
Chinese	40	0.5	1.2	
Hispanic	40	0.1	1.5	> .401
Japanese	44	0.1	1.0	
Korean	43	0.5	1.7	
Overall mean		0.4		
IPCLR (degrees)				
African American	44	0.7	2.3	
Caucasian	42	0.3	2.2	
Chinese	40	–1.7	1.7	
Hispanic	40	0.4	1.8	> .57
Japanese	44	0.6	2.2	
Korean	43	0.5	1.4	
Overall mean		0.1		
IPCLMS (degrees)				
African American	44	0.1	1.8	
Caucasian	42	–0.2	1.4	
Chinese	40	–1.6	1.2	
Hispanic	40	0.2	1.4	> .39
Japanese	44	0.5	2.3	
Korean	43	1.2	6.9	
Overall mean		0.0		
IPMFO (degrees)				
African American	44	1.4	4.7	
Caucasian	42	–0.2	3.9	
Chinese	40	–0.1	3.9	
Hispanic	40	–0.5	2.9	> .27
Japanese	44	0.5	4.5	
Korean	43	0.6	2.4	
Overall mean		0.3		
IPLRCT (degrees)				
Japanese	44	0.9	1.9	
Chinese	40	0.6	2.3	
African American	44	0.5	2.3	
Caucasian	42	0.4	2.0	> .46
Korean	43	0.2	1.5	
Hispanic	40	0.1	1.6	
Overall mean		0.4		
MIDMI (% centered)				
Caucasian	42	79	8	
African American	44	76	7	
Chinese	40	75	7	
Japanese	44	68	10	> .55
Korean	43	60	9	
Hispanic	40	59	9	
Overall mean		70		
MASLLL (% centered)				
Korean	43	81	4	
Hispanic	40	80	4	
Chinese	40	75	4	
African American	44	75	4	> .77
Caucasian	42	71	5	
Japanese	44	68	5	
Overall mean		74		

*There was no statistically significant difference among races within each parameter (*P* > .05).
SD = standard deviation.

Table 6 Summary Statistics for Profile Extraoral Parameters*

Parameter	n	Mean	SD	*P* value
PC (degrees)				
Korean	43	167.7	6.2	
Japanese	44	164.9	0.4	
Chinese	40	164.8	4.8	
Caucasian	42	163.8	4.9	< .001
Hispanic	40	163.2	5.2	
African American	44	161.6	5.4	
Overall mean		164.4		
ILC (degrees)				
Caucasian	42	144.0	15.2	
Hispanic	40	132.8	21.1	
Japanese	44	123.5	15.4	
Korean	43	122.4	12.6	< .001
Chinese	40	115.3	15.5	
African American	44	111.2	20.4	
Overall mean		128.5		
NLA (degrees)				
Caucasian	42	109.5	11.1	
Hispanic	40	105.1	12.7	
Japanese	44	97.1	10.2	
Korean	43	92.9	12.4	< .001
Chinese	40	92.5	14.2	
African American	44	90.0	15.8	
Overall mean		97.9		
MLA (degrees)				
Korean	43	142.0	13.8	
Caucasian	42	139.3	15.2	
Chinese	40	138.8	13.0	
African American	44	138.5	19.7	> .67
Hispanic	40	136.7	16.0	
Japanese	44	136.5	19.0	
Overall mean		138.6		
ULEP (mm)				
African American	43	0.3	2.6	
Chinese	44	–1.0	2.3	
Korean	40	–1.5	1.7	
Japanese	43	–1.9	2.6	< .001
Hispanic	40	–4.1	2.5	
Caucasian	42	–7.5	3.2	
Overall mean		–2.6		
LLEP (mm)				
African American	44	2.9	3.6	
Chinese	40	0.8	3.5	
Korean	43	–0.5	2.2	
Japanese	44	–1.2	2.6	< .001
Hispanic	40	–2.6	2.6	
Caucasian	42	–5.2	2.8	
Overall mean		–0.8		

*There was no statistically significant difference among races connected by vertical lines (*P* > .05).
SD = standard deviation.

positive value (+0.3), indicating their upper lip was just slightly anterior to Ricketts's plane, and their mean ULEP value was statistically different from all other races except the Chinese. In contrast, the upper lips of Caucasians and Hispanics were significantly more posterior to the Esthetic Plane than the other races, as represented by the negative values (–7.5 mm and –4.1 mm, respectively).

The mean values of LLEP ranged from +2.9 mm for the African Americans to –5.2 mm for the Caucasians, and these differences were statistically significant from each other and from the other races.

Collectively, these data indicated that both lips of African Americans were anterior to Ricketts's Esthetic Plane, with the lower lip more anterior than the upper lip. The Chinese had a lower lip anterior and an upper lip posterior to Ricketts's Esthetic Plane. The remaining four racial groups all had upper and lower lips that were posterior to Ricketts's line.

Discussion

Frontal and Profile Extraoral Parameters

The parameters selected for study are used in prosthodontics to assess facial esthetics[27,29,31,33–35] despite a lack of information dealing specifically with full frontal facial analysis.[36] However, these parameters have become part of widely held esthetic canons in the prosthodontic literature relating to eye-tooth and eye-mouth relationships and continue to be used in dentistry today.[2,3,37–40]

Five of the six profile extraoral parameters (PC, ILC, NLA, ULEP, and LLEP) were significantly different for different races, suggesting that esthetic guidelines may need to be developed for each race. Only the mentolabial angle was not significantly different among the six races, and it may be useful in establishing an esthetic norm for the facial appearance for patients from the races studied.

Frontal Extraoral Analysis

The seven frontal extraoral parameters, while slightly different among subjects, were strikingly similar for all races. This finding is consistent with the belief and teaching of the strong correlation between eye-mouth and eye-tooth relationships in prosthodontics. These relationships are important factors in establishing guidelines for optimal tooth position for ideal facial esthetics, irrespective of race or gender, and might serve as a standard in the esthetic evaluation of patients from the six races studied.

The first five frontal extraoral parameters were compared for their parallelism to the horizontal interpupillary line. No significant interracial or gender differences were noted, which is in agreement with Peck et al's[41] study of skeletal asymmetry in esthetically pleasing faces.

The outcomes for the midline position of the maxillary central incisors were consistent with results of Miller et al,[40] who found the midline deviates from a line bisecting the interpupillary line in 25% of the population, with no significant racial or gender differences (75% coincidence rate). Our findings of a 30% deviation (22% to the left and 8% to the right of the midline) and a 70% coincidence rate were comparable.

The relative parallelism of the maxillary anterior smile line to the lower lip is also consistent with previously reported results. Tjan et al[8] noted that the incisal curvature of the maxillary anterior teeth follows the lip curvature in 85% of subjects (compared with the 75% reported here), with no significant gender differences.

Profile Extraoral Analysis

The six extraoral profile parameters are of direct clinical relevance to the specialty of prosthodontics, and our findings agreed with a number of other published reports.[31,36,42–44] However, caution is urged when making direct comparisons because of lack of standardization of some soft tissue landmarks in these earlier studies.[45,46] For example, the mean extraoral profile convexity angle for the different racial groups examined in this investigation was not consistent with results reported previously.[31,42,43,46]

The angular parameters, which most reflect dentolabial relations and can be more readily manipulated by prosthodontists, are the interlabial, nasolabial, and mentolabial angles. The linear measurements of upper and lower lip relations to Ricketts's Esthetic Plane[32] were included to assess the clinical usefulness of this parameter when evaluating non-Caucasian patients.

Chiu and Clark[31] included five values for soft tissue profile analysis of a southern Chinese sample of 28 men and 31 women. Three of their profile variables, interlabial contour and upper and lower lip position relative to the Esthetic Plane, exhibited significant variations from comparable Caucasian values. A study of 180 Thai females with sexual dimorphism found profile convexity measurements that differed from other comparable studies.[47] Morris[48] reported a mean interlabial contour angle of 133 degrees (± 10) for a group of professional women models compared to a value of 128.4 degrees found in this study.

NLA and MLA guide clinicians in the replacement of missing anterior teeth. The nasolabial angle in dentate subjects has been estimated to be 107

degrees, with a wide standard deviation.[49,50] The NLAs in this study were significantly different among the races, which is consistent with previous reports.[31,47,49,51] However, no significant interracial or gender differences were found for the MLA (mean of 139 degrees), suggesting this parameter also might serve as a norm for patients of different ethnic orgins.

The lack of a standard methodology for examining facial appearance precludes comparisons of some data with outcomes from other studies.[52,53] Limitations of sample size, although consistent with previous published reports, also must temper extrapolation of outcomes from this investigation. Nevertheless, it is evident that racial and gender similarities and variations exist among the soft tissue extraoral frontal and profile parameters. As evidenced here, some parameters might serve as norms for patients of different ethnic orgins. Part 2 in this series explores the racial and gender differences of six intraoral dental parameters used to assess facial appearance in these same test subjects.[54]

Conclusions

Given the size of the racial groups, additional research with larger patient populations would be needed to confirm or refute the following trends.

Frontal Extraoral Parameters

1. No variations of the seven frontal extraoral parameters were found among races or between genders. If the results of this study can be extrapolated to larger populations, these parameters may be helpful norms for evaluating the facial appearance of men and women of the six races studied.
2. Parameters such as the relationships between the interpupillary line and the interorbital line, the lip commissures at rest, the lip commissures at maximum smiling, the maxillary anterior occlusal plane, and a line joining the cusp tips of the maxillary canines were essentially parallel to the interpupillary line in all six racial groups, with a variation of less than 1 degree.
3. The midline was perpendicular to the interpupillary line in 70% of subjects, with no significant racial or gender differences; 22% deviated to the left, and 8% deviated to the right.
4. During maximum smiling, the curvature of the maxillary anterior teeth (smile line) was parallel to the curvature of the superior border of the lower lip for 74% of all patients, with no race or gender differences.

Profile Extraoral Parameters

1. Of all the profile parameters, only the mentolabial angle (mean of 139 degrees) was statistically similar for all six races, suggesting this parameter may be a norm for patients of different ethnic origins.
2. The remaining five profile extraoral parameters (profile convexity, interlabial contour, nasolabial angle, and upper lip and lower lip relations to Ricketts's Esthetic Plane) had significant interracial variation. These five profile extraoral parameters may be more useful in identifying differences in facial appearance than the seven frontal extraoral parameters.
3. Caucasians and Hispanics had significantly greater nasolabial angles (110 degrees and 105 degrees, respectively) than the other four races.
4. African Americans had upper lips anterior to Ricketts's Esthetic Plane (mean +0.3), while Chinese had an upper lip posterior to the plane (–0.9).
5. African Americans and Chinese had lower lips anterior to Ricketts's Esthetic Plane (+2.9 mm and +0.8 mm, respectively), and Caucasians had lower lips more posterior to the plane (–5.2 mm).

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