

Cephalometric Features of Filipinos with Angle Class I Occlusion According to the Munich Analysis

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Abstract: The purpose of this study was (1) to establish cephalometric norms for soft tissue, skeletal and dental relationships among Filipino adults; and (2) to compare these norms with the accepted German standards. Eighty-one Filipino subjects, 44 men and 37 women, were selected from the student population of the Manila Central University on the basis of the following criteria: (1) natural-born ethnic Filipino, traced up to their great-grandparent's generation; (2) good facial aesthetics; (3) Angle Class I occlusion with no crowding; (4) all teeth present (third molars may or may not be present); and (5) no previous history of orthodontic treatment. Clinical examinations and interviews were conducted to ensure that the established criteria were observed properly. The German subjects, 78 men and 123 women, were selected from Hamburg and Munich on the basis of the same criteria. Each lateral headfilm was traced and digitized, and differences between the cephalometric measurements of the two groups were compared using the Student's *t*-test and cephalometric superimpositions. Significant differences between the two groups were seen predominantly in the lower third of the face. The Filipinos showed more posteriorly inclined apical bases and a less prominent chin. Dentally, they exhibited a bimaxillary dental protrusion resulting in an acute dental pattern and a convexity of the soft tissue profile. These findings suggest that ethnic differences in facial traits exist and awareness of the dentofacial pattern of each ethnic group will ensure better success of treatment in establishing optimal facial harmony. (*Angle Orthod* 2004;75:63–68.)

Key Words: Filipino, Bimaxillary dental protrusion, Ethnic difference, Cephalometric norms

INTRODUCTION

The cephalometric evaluation of craniofacial morphology is one of the most significant tools in orthodontic diagnosis and treatment planning. An analysis of cephalometric headfilms provides a useful measure of skeletal morphology and allows a correlation of dental and skeletal factors in malocclusion.¹ Because the morphologic features of races and ethnic groups are distinct from each other, knowledge of the normal dentofacial patterns of each ethnic group is important.²

For several decades, cephalometric standards for each race and ethnic group have been established.^{3–33} The Stein-

er, Downs, and Sassouni analyses have been used predominantly since the 1960s. The Munich cephalometric analysis was developed by Hasund from Bergen, and was modified in Germany by Segner and Rudzki-Janson.³⁴ Many of the measurements applied in this analysis are identical to other widely accepted analyses.

Comparative cephalometric studies have proven that differences in the craniofacial morphology exist among races and ethnic groups.^{10–30} These studies have revealed a pattern, wherein the non-Caucasian ethnic groups consistently displayed profile convexities due to bilabial dental protrusion when compared with Caucasians.^{10–15,18–30} Chung et al²⁸ investigated the racial variation of cephalometric measurements among Caucasians, Japanese, Chinese, Filipinos, and Hawaiians and found that the Chinese had the greatest incisal inclination and the Caucasians the least. They also showed that among non-Caucasians, especially the Orientals, there was a general tendency toward bimaxillary protrusion due to an imbalance of tooth dimension to the alveolar bone. Lew's²⁹ study compared the craniofacial morphology of the Chinese, Malay, and Indian groups and showed that the Indians displayed less protrusive upper and lower incisors compared to the two ethnic groups. However, when compared with Caucasians, the Indians exhibited a convex dental pattern.³⁰ Similar findings were seen among

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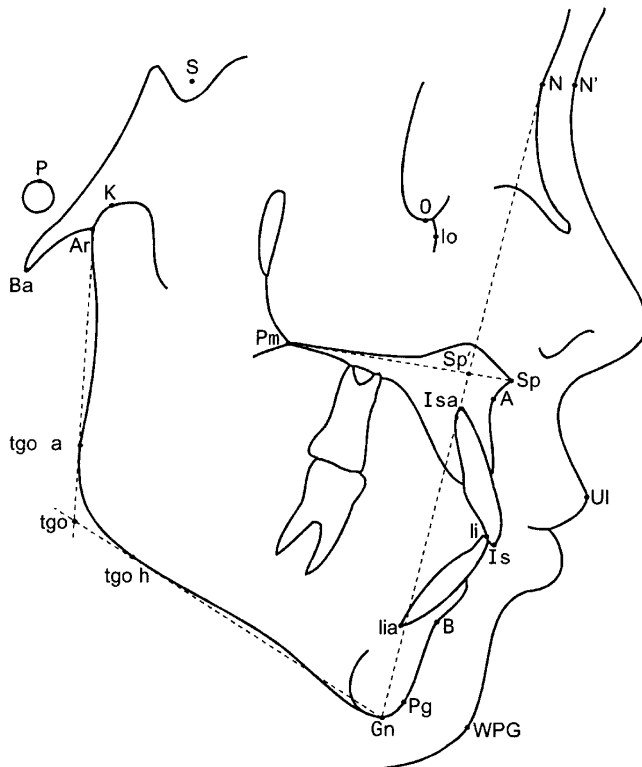


FIGURE 1. Cephalometric landmarks used in the Munich analysis.³⁴ The less commonly used landmarks are defined below: Spina (Sp), the point Sp is the most anterior lying point on the anterior nasal spine. The point lies in the midsagittal plane; Pterygomaxillare (Pm), the intersection of the posterior contour of the maxilla with the contour of the hard palate; Gnathion (Gn), the most inferior point on the mandibular symphysis in the midsagittal plane. Also referred to as menton in most cephalometric analyses; Spina prime (Sp'), the point Sp' is defined as the intersection of the nasal line and the nasion-gnathion line; Gonion-tangent point (tgo), the point tgo is defined as the intersection of the mandibular line and the ramus line.

African Americans, African Bantu, Iranians, Mexicans, Saudis, Brazilians, Jews, Egyptians, and Israelis.^{2,18-28}

At present, three cephalometric studies on Filipino dentofacial morphology were developed according to Steiner analysis.³¹⁻³³ These studies showed that the Filipinos exhibit a convex profile and protrusive lips due to a more proclined upper and lower incisors.

This study aims to establish cephalometric norms for soft tissue, skeletal, and dental relationships among male and female Filipino adults according to the Munich analysis and to compare these norms with the accepted German standards.

Brief review of the Filipino racial ancestry

Archaeology has proven that, during the prehistoric times, the Malays and Indonesians left their ancestral home in Southeast Asia, crossed the seas in sailboats, and settled in the Philippine archipelago. There they came into contact with the native Negritos and interracial marriages took

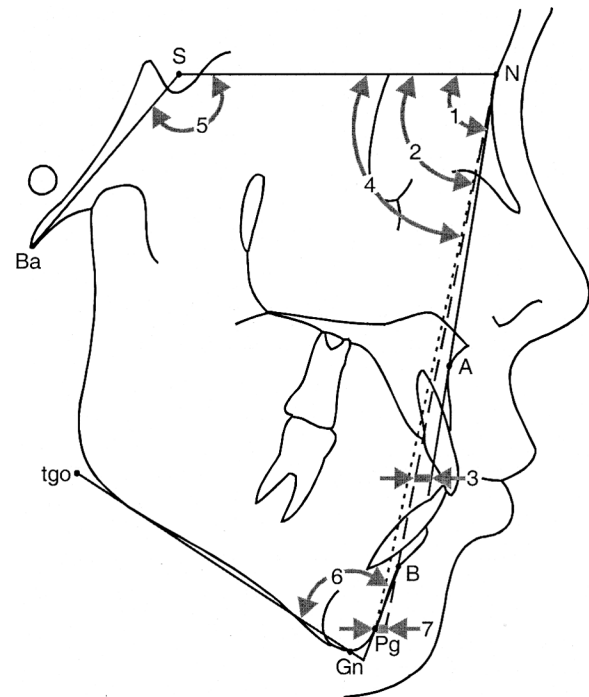


FIGURE 2. Linear and angular measurements in the sagittal plane: (1) SNA; (2) SNB; (3) ANB; (4) SNPg; (5) NSBa; (6) Nordeval angle; and (7) Pg-NB (mm).

place. Out of these racial mixtures emerged the Filipino people. The cultural influences of both India and Arabia came to the Philippine shores through Malaysia, whereas the Chinese influences came directly from China.

In subsequent years, the Filipino intermarried, not only with the Indians, Chinese, and Arabians but also with the Spaniards, who colonized the Philippines for 333 years, and the Americans, who conquered the country for four decades. Intermarriages also occurred with the Japanese, the British, the French, the Germans, and other peoples of the world. Today, it may be said that the blood of the East and West meet and blend in the Filipino veins. According to the noted American anthropologist, Dr H Otley Beyer,³⁵ the racial ancestry of Filipinos is: Malay, 40%; Indonesian, 30%; Chinese, 10%; Indian (Hindu), 5%; European and American, 3%; and Arabian, 2%.

MATERIALS AND METHODS

Samples

The Filipino subjects, 37 women and 44 men, were selected from the student population of the Manila Central University on the basis of the following criteria: (1) natural-born ethnic Filipino, traced up to the generation of great-grandparents; (2) good facial aesthetics; (3) Angle Class I occlusion with no crowding; (4) all teeth present (third molars may or may not be present); and (5) no previous history of orthodontic treatment. Clinical examinations and interviews were conducted to ensure that the established criteria

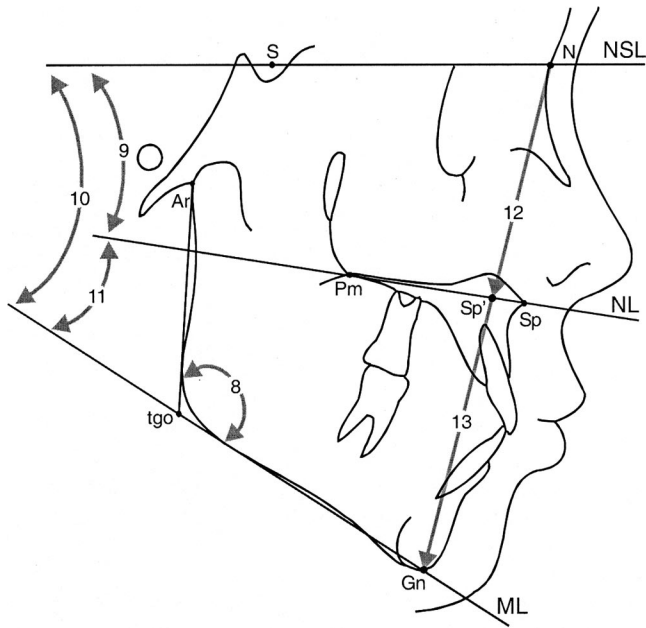


FIGURE 3. Linear and angular measurements in the vertical plane: (8) Gn-tgo-Ar; (9) NL-NSL; (10) ML-NSL; (11) ML-NL; (12) N-Sp' (mm); and (13) Sp'-Gn (mm).

were observed strictly. A total of 201 German subjects from Hamburg and Munich comprised the German sample (123 women and 78 men). They were selected on the basis of the same criteria applied to the Filipino subjects. The average age of both sample groups was 18 years.

Cephalometric analysis

Tracing of the films was done at the University of Munich by the principal investigator. All relevant linear and angular parameters were measured and digitized with the aid of a computer program, DiagnoseFix (Dr Jörg Wingberg, Diagnostik Wingberg GmbH, Buxtehude, Germany). The error of the method was determined by retracing and remeasuring the films, which generated an average error of less than 0.4 mm for the linear measurements and 0.5° for the angular measurements.

The Munich cephalometric analysis consists of 14 angular measurements, five linear measurements, and an index (Figures 1–5). The Munich analysis differs in some landmark identification, terminology, and angle measurements. In the Munich analysis, Gnathion is the lowest point on the symphyseal shadow of the mandible and Menton does not exist (Figure 1). The mandibular plane is called the mandibular line (ML), the palatal plane is called the nasal line (NL) and the SN plane is called the nasion sella line (NSL). The mandibular angle is called Gn-tgo-Ar and is formed by the mandibular plane and the ramal plane. The point of intersection of these two planes is tgo, the gonion tangent point (Figure 3). The Nordeval angle is the angle formed by the mandibular plane and the B-Pg plane, thus

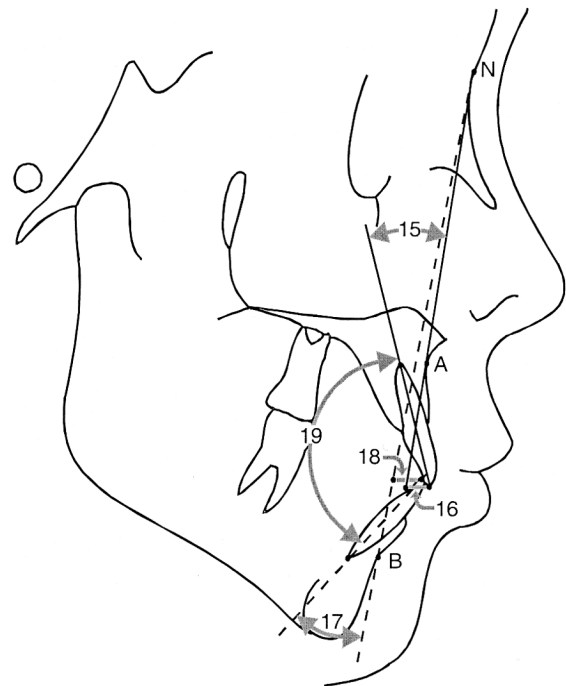


FIGURE 4. Dentoalveolar measurements: (15) OK1-NA; (16) OK1-NA (mm); (17) UK1-NB; (18) UK1-NB (mm); and (19) OK1-UK1.

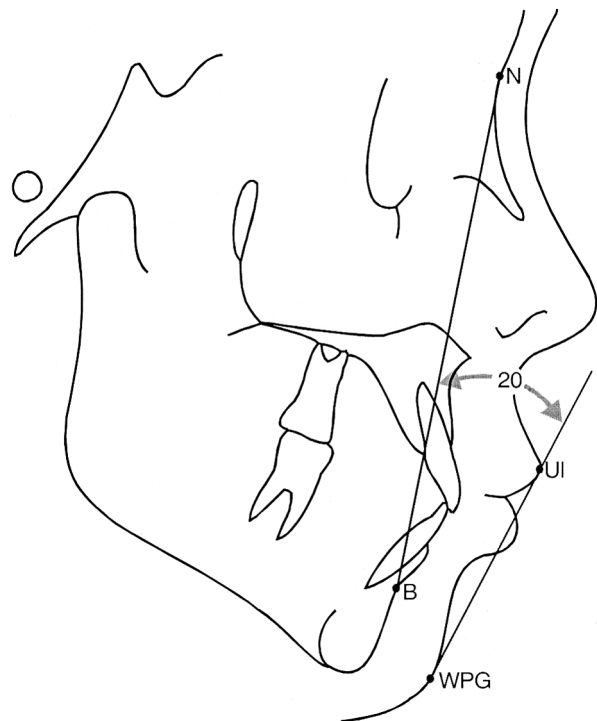


FIGURE 5. Soft tissue measurement: (20) Holdaway angle.

describing the chin prominence (Figure 2). The interincisal angle is called OK1-UK1, and OK1 refers to the upper incisor and UK1 to the lower incisor (Figure 4). The Holdaway angle relates the soft tissue profile to the hard tissue profile and is formed by the NB plane and the plane tangent

TABLE 1. Adult Male Comparison of Group Means Between Filipino (n = 44) and German (n = 78) Samples^a

Variable	Filipinos		Germans		Significance
	Mean	SD	Mean	SD	
Skeletal					
SNA	83.4	3.2	81.6	3.5	**
SNB	80.1	2.8	79.8	3.2	ns
ANB	3.3	2.1	1.8	2.1	**
SNPg	80.0	3.1	81.2	3.1	*
NSBa	129.4	4.6	131.5	3.9	**
Gn-tgo-Ar	120.5	6.4	121.3	5.9	ns
N-angle	68.4	6.1	59.2	5.2	**
Pg-NB (mm)	-0.1	1.6	2.8	1.7	**
NL-NSL	8.7	2.5	7.7	3.1	*
ML-NSL	32.0	5.0	29.8	5.2	**
ML-NL	23.2	4.9	22.0	5.8	ns
N-Sp' (mm)	57.9	3.1	53.9	5.7	**
Sp'-Gn (mm)	71.3	5.5	67.3	5.9	**
N-Sp'-Sp'Gn (%)	81.4	4.7	80.5	8.4	ns
Dental					
OK1-NA	26.7	6.1	20.0	6.7	**
OK1-NA (mm)	6.6	2.4	3.8	2.4	**
UK1-NB	31.1	5.0	22.9	6.6	**
UK1-NB (mm)	8.6	2.5	3.8	2.5	**
OK1-UK1	118.9	7.5	135.2	9.7	**
Facial					
H-angle	15.5	3.9	7.2	4.7	**

^a SD indicates standard deviation.

* $P < .01$; ** $P < .001$; ns, not significant.

to the soft tissue Pogonion and the upper lip, as described by Segner and Hasund (Figure 5).³⁶

Statistical analysis

Descriptive statistics (means and standard deviations) were calculated using the SPSS program version 11.5 (SPSS Inc, Chicago, Ill). The results were tabulated according to gender and compared with established German cephalometric norms using Student's *t*-tests.

Superimposition

The craniofacial morphologies of the Filipinos and Germans are compared by superimposing both tracings registered at the sella and the SN lines.³⁷

RESULTS

Tables 1 and 2 present the statistical comparisons of the craniofacial features between the two sample groups. Among the men, four (SNB, Gn-tgo-Ar, ML-NL, N-Sp'-Sp'Gn) of the 20 cephalometric parameters showed no significant differences in measurements. The SNA, ANB, Nordeval angle, ML-NSL, N-Sp', Sp'-Gn, dental and soft tissue variables were significantly larger among the Filipino men, whereas the interincisal angle, OK1-UK1, was significantly smaller, exhibiting an acute dental pattern.

TABLE 2. Adult Female Comparison of Group Means Between Filipino (n = 37) and German (n = 123) Samples^a

Variable	Filipinos		Germans		Significance
	Mean	SD	Mean	SD	
Skeletal					
SNA	83.3	3.5	82.9	3.4	ns
SNB	79.6	2.8	81.4	3.4	**
ANB	3.2	1.9	1.5	2.1	**
SNPg	79.2	2.8	82.9	3.6	**
NSBa	132.1	4.9	130.4	5.3	*
Gn-tgo-Ar	121.4	5.6	120.0	7.1	ns
N-angle	69.2	4.8	60.9	5.6	**
Pg-NB (mm)	-0.8	1.7	3.2	2.1	**
NL-NSL	10.3	3.3	7.2	3.3	**
ML-NSL	34.4	3.7	26.4	5.9	**
ML-NL	24.1	4.4	19.0	5.5	**
N-Sp' (mm)	54.5	2.6	55.4	3.0	*
Sp'-Gn (mm)	66.5	4.5	69.6	4.9	**
N-Sp'-Sp'Gn (%)	81.1	8.1	79.7	5.6	ns
Dental					
OK1-NA	26.6	4.8	22.9	6.6	**
OK1-NA (mm)	6.7	2.3	4.6	2.2	**
UK1-NB	32.8	5.0	22.9	6.1	**
UK1-NB (mm)	8.6	2.0	3.8	2.1	**
OK1-UK1	117.0	6.2	132.6	8.6	**
Facial					
H-angle	15.2	3.5	8.1	4.4	**

^a SD indicates standard deviation.

* $P < .01$; ** $P < .001$; ns, not significant.

Three (SNA, Gn-tgo-Ar, N-Sp'-Sp'Gn) out of the 20 cephalometric parameters showed no significant differences among the women. The ANB, Nordeval angle, NL-NSL, ML-NSL, ML-NL, dental and soft tissue variables were significantly larger among the Filipino women, whereas the interincisal angle, OK1-UK1, was significantly smaller, displaying an acute dental pattern. The German women demonstrated a significantly greater Sp'-Gn compared with the Filipino women.

The differences in craniofacial morphology are presented by superimposing the Filipino and German tracings on the sella and the SN lines (Figures 6 and 7). Skeletally, the Filipinos exhibited maxillary prognathism, lesser chins, and steeper palatal and mandibular apical bases than that found among the Germans. The Filipino men exhibited longer facial heights, whereas the Filipino women displayed shorter facial heights compared with their German counterparts. Dentally, the Filipinos exhibited a bimaxillary dental protrusion, resulting in a characteristic convex profile.

DISCUSSION

In a study by Richardson, "ethnic group" was defined as a nation or population with a common bond such as a geographical boundary, a culture or language, or being racially or historically related.^{38,39} This study is the first to compare the Filipino craniofacial morphology with German

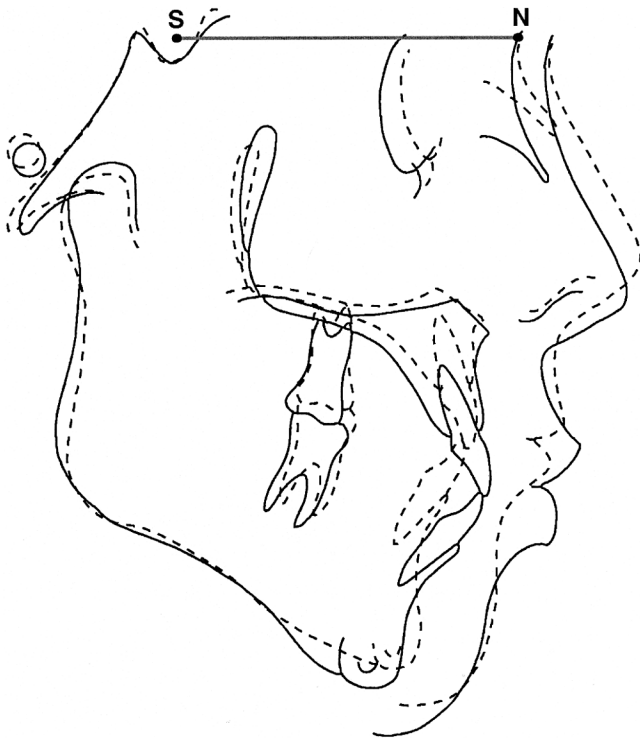


FIGURE 6. Cephalometric superimposition of Filipino (—) and German (---) male skeletal, dental, and soft tissue variables.

Caucasians. Because both groups belong to different races and ethnic groups, a better understanding of both morphologies was achieved using statistical comparisons and cephalometric superimpositions.

Skeletal relationships

The larger ANB readings among the Filipinos suggested a tendency toward lower incisal proclination and dental compensation. The smaller SN-Pg angle, Pg-NB (mm) measurement, and greater Nordeval angle showed that the Filipinos have less prominent chins than the Germans. They also exhibited a greater posterior rotation of the maxilla and mandible. Filipino men exhibited longer facial heights compared with the Germans because of longer N-Sp' (mm) and Sp'-Gn (mm) as well as posteriorly rotated apical bases (maxilla and mandible). Although the Filipino women revealed a more posteriorly inclined apical base, their N-Sp' (mm) and Sp'-Gn values were shorter compared with the Germans who displayed longer facial heights.

Dental relationships

The characteristic bimaxillary dental protrusion seen among other Asians were also observed among the Filipino samples.^{1,10-12,14,15,28,29} They displayed more procumbent upper and lower incisors in relation to both the NA and NB planes resulting in a mean acute interincisal angle of 118° as compared with 135° found among the Germans. This

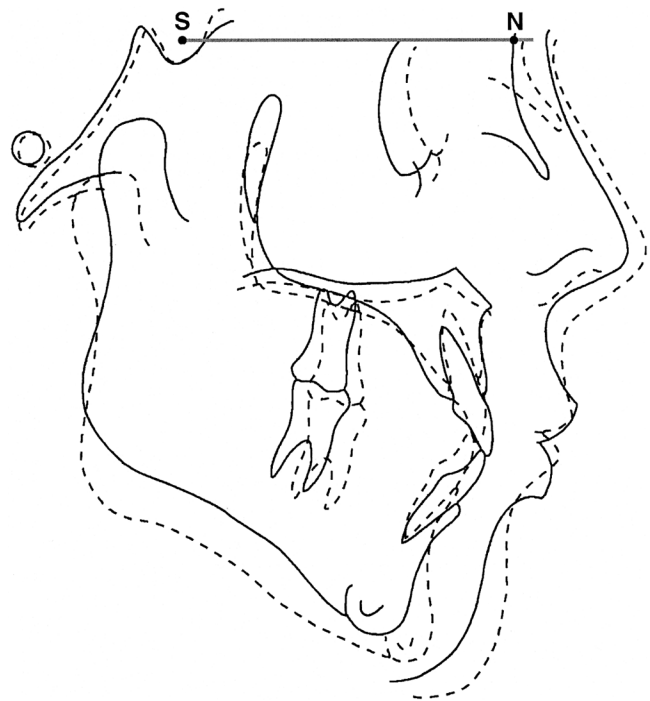


FIGURE 7. Cephalometric superimposition of Filipino (—) and German (---) female skeletal, dental, and soft tissue variables.

present finding agrees with Enlow's reported perception of the oriental facial pattern,⁴⁰ and it agrees with studies reporting that those facial parameters closer to the dentoalveolar areas show the greatest differences among ethnic and racial groups.^{19,38,41}

Soft tissue profile

Compared with the Germans, the Filipinos' Holdaway angle was significantly greater thus exhibiting more lip protrusion. Because of an acute interincisal angle, less prominent chin, and posteriorly positioned mandible, the Filipinos revealed a convexity in the facial profile. The Germans displayed a straight profile, a characteristic feature found among Caucasians. These findings correspond with Joson's study⁴² on the soft tissue profile of Filipinos with normal occlusion.

CONCLUSIONS

Because 80% of the Filipino racial ancestry consists of Malay, Indonesian, and Chinese, the characteristic features found in these groups of people were also seen among the Filipinos.^{1,28,29} Bimaxillary dental protrusion due to a more proclined upper and lower incisors and more protruded lips are naturally occurring facial characteristics of the Filipinos. These findings imply that orthodontists treating Filipino patients should consider these results before performing extractions designed to reduce bimaxillary protrusion and facial convexity. The present study suggests the need

to treat patients from different racial and ethnic groups differently using cephalometric norms specific to each group.

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