The Craniofacial Skeleton At The Age Of One Month

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INTRODUCTION

A major problem in craniofacial morphology is to be found in the time of the registration of racial differences. Specifically, we may pose the question, "How early in life can we recognize valid and objective differences in the skull and face of American Whites and American Negroes?" This is far more than an academic problem. At the *Growth Center* one of us (W. M. K.) is constantly serving as referee for adoption agencies and the courts where there is a problem of the racial origin (or racial synthesis) of an infant. Obviously an *age* factor as well as a *racial* factor is at stake. We are familiar, of course, with stated racial differences in adult White and Negro skulls and heads. These may serve as leads, but—since they *are* adult—we must expect at least quantitative differences, and possibly qualitative differences. We may add that the legal aspects of adoption are our major concern, insofar as race is a factor, but this study has further medicolegal implications, i.e., the identification, in racial terms, of immature crania. The entire problem, reduced to essentials, is one of racial genetics: the race—entrenched traits of a White and Negro craniofacial complex.

MATERIAL AND METHOD

At the Growth Center we have on file 150 lateral roentgenographic cephalometric x-ray films of American White and Negro infants one month of age (± 5 days). The Broadbent-Bolton roentgenographic cephalometer was employed. The data were taken from a study in which parental background was known: 1) in the Whites ethnic background; 2) in the Negroes reasonable degree of Negro-white admixture. Carefully selected samples of the two series were utilized so that we finally selected for Negroes 24 males, 30 females; and for Whites 30 males, 17 females.

On the tracing of each of the lateral head x-ray films the following angles and measurements were taken (see Figure 1):

1. *Symphyseal angle:* the inner angle formed by the mandibular plane (line tangent to corpal border at gonion and menton) and a line drawn from the midpoint of the symphyseal shadow (by inspection) and menton.
2. *Palatomandibular plane angle:* the angle formed by the mandibular plane and the palatal plane (line from anterior to posterior nasal spine).
3. *Craniopalatal plane angle:* the angle formed by the cranial plane (from midpoint of sella turcica (by inspection) to nasion and the palatal plane.
4. *Basal angle:* the angle formed by a line tangent to the superior clinoid process and the superior margin of the orbit and a line through the midpoint of the spheno-occipital synchondrosis (by inspection) and basion.

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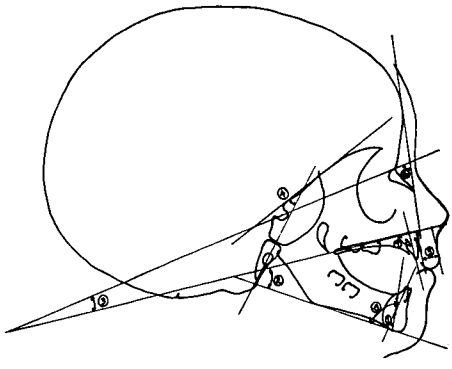

Figure 1 Angles and measurements employed in this study.

5. *Thickness of the upper lip* (in mm): the linear measurement between a line perpendicular to the palatal plane from the labial bony plate of the premaxilla and a line perpendicular to the palatal plane tangent to the most prominent (anterior) aspect of the outline of the upper lip.
6. *Upper facial angle:* the angle formed by a line tangent to the outer curvature of the frontal bone and through the anterior nasal spine and the cranial plane (S-Na).
7. *Inclination of the upper deciduous incisor:* axial inclination of this tooth to the palatal plane.
8. *Inclination of the lower deciduous incisor:* axial inclination of this tooth to the mandibular plane.

Pertinent Literature

The earliest study, in terms of age of material, is that of Hauschild ('37) who studied embryonic skulls of a small series of Whites and Negroes of 49-50 mm crown-sole age (one Negro of 36 mm added). The essential racial differences were found to be as follows, expressed in terms of Negro compared with White, i.e., the traits described are negroid: 1) a long, deep, and narrow posterior cranial fossa; a typical negroid "cocoon form" related to the length of the planum basale, a distant caudal divergence of the exoccipitals, a marked lengthwise extension of the occipital curve, and the height, flatness and lateral positioning of the large otic capsule; 2) a long cleft-like foramen jugulare (fissura metotica), medial to the exoccipital, caudal to a deep recessus jugularis (this trait is not seen in white embryonic crania); 3) a long sphenoid region so that the cranium is divided into a chordal and a prechordal part; the nasal portion is strongly set apart, while the form of the cranium is much less so; 4) a long, projecting nasal capsule; yet there is no direct prognathism, even though a trend may be discernible; as a whole, the Negro cranium shows a larger precerebral moiety of the nasal capsule; 5) a larger cranial base angle, related to the prominence of the sphenoid and ethmoid regions; here is the cartilaginous anlage of the definitive prognathism of the Negro cranium.

Cotton, Takano, Wong and Wylie ('51) studied craniofacial ethnic differences via roentgenographic cephalometry in Negroes, Chinese and Japanese, comparing their findings with those for Whites studied by Downs ('48), also roentgenographic cephalometric. The nonwhite data covered a teen-age and adult series, while the White data covered 11:6-17:6. A Downs analysis ('48) was employed. In 1960 Altemus employed comparable methods on 80 American Negro children 12:0-16:0.

In Figure 2 Altemus (his Fig. 1) presents a graphic polygon (Downs analysis), his findings for American Negro children showing the mean and the total range of variation. In Figure 3 Altemus (his Fig. 2) presents similar polygons (means only) for his series combined with means of Cotton, Takano, Wong and Wylie. In Figure 4 Altemus (his Fig. 6) presents lateral

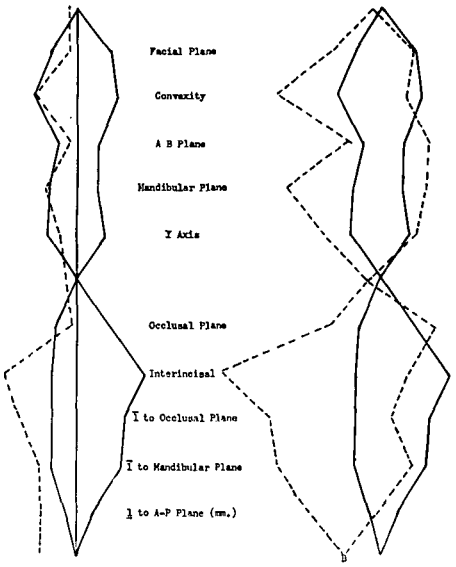

Figure 2 Graphic polygons of the Downs analysis in American Negro children age 12:0-16:0. To the left the dotted line gives mean values, to the right the dotted lines give the total range of variation (Fig. 1 in Altemus, '60).

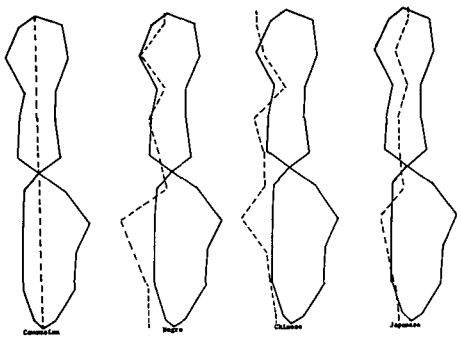

Figure 3 Graphic polygons of the Downs analysis for White, Negro, Chinese, and Japanese. The solid polygon is the White range, the dotted lines are, respectively, ethnic means. (Fig. 2 in Altemus, '60).

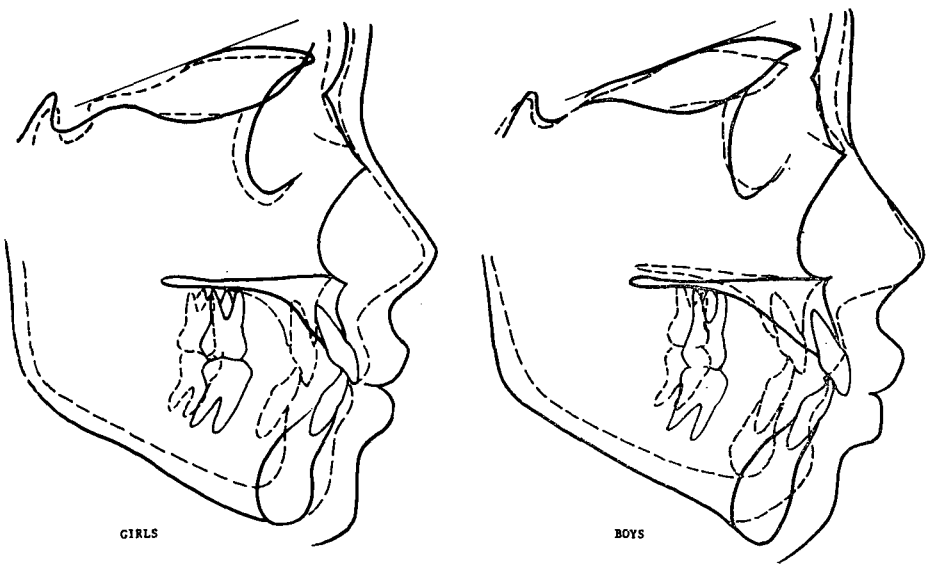

Figure 4 Comparative standard tracings of American White (- - -) and American Negro (——) children, age 12:0-14:0, with normal occlusion. Superimposition is on a line tangent to the floor of the anterior cranial fossa. (Fig. 6 in Altemus, '60).

Table I

Craniofacial Angles and Dimensions in White and Negro Infants Age One Month

	WHITE		NEGRO	
	male	female	male	female
1. Symphyseal Angle	78.2±6.2	77.7±4.3	88.0±5.9	86.6±6.8
2. Palatomandibular Plane Angle	34.1±3.1	32.9±4.6	38.7±4.3	38.4±4.2
3. Craniopalatal Plane Angle	8.9±1.9	9.7±2.1	8.3±4.2	6.8±3.7
4. Basal Angle	22.8±5.8	17.0±5.4	19.4±5.2	18.4±5.8
5. Thickness of the Upper Lip (mm)	6.3±1.2	6.9±1.3	10.3±1.4	9.8±1.3
6. Upper Facial Angle	74.5±0.4	73.7±4.2	80.8±4.4	78.9±3.4
7. Inclination of $\underline{1}$	91.4±3.9	91.7±5.5	94.2±5.1	95.1±4.9
8. Inclination of $\overline{1}$	87.0±6.5	84.9±6.3	95.3±6.7	96.4±5.9

tracings of head x-ray films comparing 12:0-14:0 American White* and American Negro children.

As between Whites and Negroes, for the age period covered, Altemus concludes as follows: 1) in over-all absolute size of head and face Negroes are larger; 2) the prognathism of the Negro is largely dento-alveolar; 3) in the Negro lower facial height exceeds upper, mandibular corpal length exceeds anterior cranial base length, and the palatomandibular angle is larger than the palatosupraorbital angle; 4) the skeletal patterns (in profile) of White and Negro children "seem to be similar."

Björk ('50) has studied the Bantu of S. Africa via roentgenographic cephalometry.

Results

When the standard tracings of the lateral x-ray films of our series were superimposed, by sexes, the following basic differences emerged:

1. In both White and Negro infants the male is overall larger.
2. Lower facial height in the Negro infant exceeds that of the White.
3. The soft tissue outline of the upper lip is more prominent in the Negro infant.
4. Both nasion and the frontal bone in the White infant are more anterior relative to lower face, thus giving the White infant a straighter facial profile.
5. The palatal (maxillary) outline is similar in both races.
6. The mandible and the symphyseal angle are smaller in White infants.
7. The Negroid palatal slope is greater, as is the gonial angle; corpal length and ramal height do not differ.
8. In the Negro infant the dental complex, as a whole, is more anteriorly situated.
9. The Negro infant shows greater procumbency in incisal inclination, both upper and lower.

In Table I our findings are presented for White and Negro, male and female. The mean and the standard deviation (± 1 S.D.) are shown:

When the data were critically tested the results were as follows:

*The American White standards are those developed at the Growth Center.

1. "t"-values of the gonial angle and the inclination of $\underline{1}$ were so small that they were of no significance and were discarded.
2. The symphyseal angle was found to be greater in the Negro infant than in the white. (Probability >.001)
3. The palatomandibular plane angle in the Negro is greater, as is, consequently, the lower facial height. (Probability >.001)
4. With regard to the SNa-palatal plane angle, the Negro infant has a superiorly positioned ANS in relation to the SNa plane. The probability of overlap in measurement is greater in the male and, therefore, was discarded.
5. The Negro infant has basion more posterior in position to that of the white infant. The probability of overlap in the female sample was too great to be of any significance.
6. Comparing the soft tissue thickness of the upper lip, the Negro was found to have a thicker anteroposterior dimension; however, since this is in linear measurement, it can be applied only to members of the same age group. (Probability >.001)

Discussion

The greater negroid palatomandibular plane angle seems to influence and characterize the architecture of the adjacent structures of the skull. The ANS is superiorly positioned in the Negro infant whose mandible is downward in position and swings backward. The posterior positioning of the basion in the Negro infant may be associated with the position of the mandible.

The relationship between basal (nonalveolar) and alveolar bone is in a sense foreshadowed by the symphyseal angle as is shown in measurement of the symphyseal angle and the inclinations of 1 and $\underline{1}$. In these measurements future negroid procumbency of the lower incisors can already be seen. Hence, the basal bone may predicate the orientation of alveolar bone, at least in the mandible, and almost certainly in the maxilla. The measurement of the prominence of the frontal bone reveals the significance of the lower face in determination of the facial profile. Since this study was made on a cross-sectional basis, discussion of growth pattern is not possible. It is necessary only to mention that the characteristic facial pattern of the individual is established at a very early age, and any deviation from this pattern will be caused by the working-out of ontogenesis. If there is any change, it will be due to the pattern of directional and quantitative growth.

In Figures 5 and 6 we present lateral tracings of White and Negro males and White and Negro females based on our findings.

In Figure 7 we present a polygon similar to that of the Downs analysis. However, for each sex, the polygons are so drawn that the reading to the left shows the white infant characteristic configuration while that to the right shows the Negro infant characteristic configuration.

Summary

A sample of 101 White and Negro infants, one month of age, was analyzed as the initial phase of a serial study of growth changes in skull and face from birth to 6:0. The data are from the files of the Philadelphia Growth Center.

Racial traits of White and Negro infants were studied by means of standard tracings of lateral roentgenographic cephalometric x-ray films. Measurements of these tracings were made and analyzed.

This study is a contribution to the time-linking of racial differences in skull, face, jaws, and teeth in American Whites and Negroes. It is useful in the analysis of growth pattern and potential

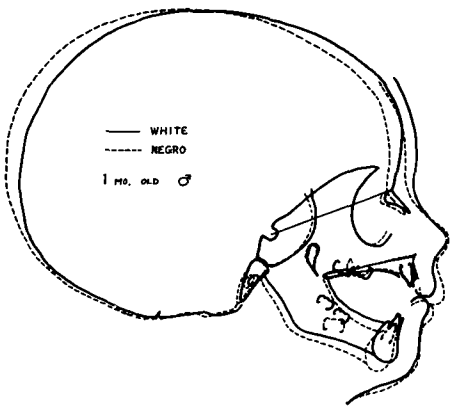

Figure 5 Standard tracing of American White (——) and Negro (- - -) male infants, age one month.

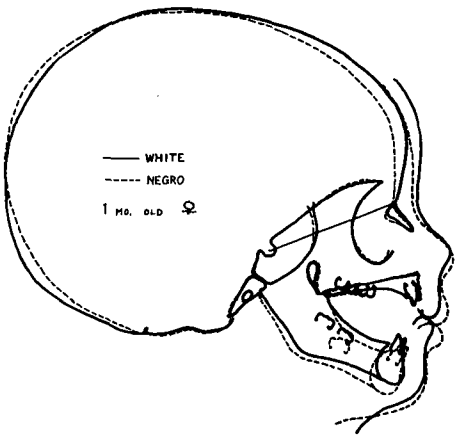

Figure 6 Standard tracings of American White (——) and Negro (- - -) female infants, age one month.

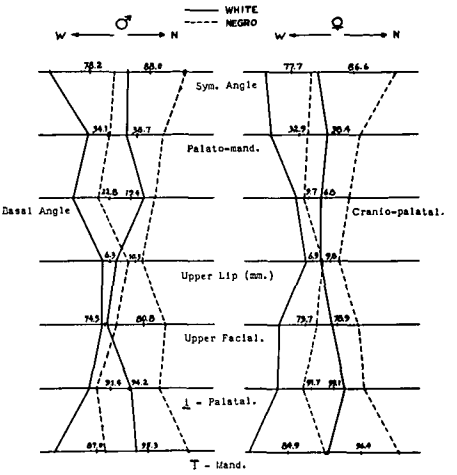

Figure 7 Polygons of the angles and dimensions of White and Negro infants, age one month. The readings for each sex show the White (——) pattern to the left, the Negro (- - -) to the right.

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