H53 Morphological Characteristics of Ancestry in the Fetal/Newborn Human Skeleton

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After attending this presentation, attendees will understand features in the fetal/newborn skeleton that are associated with ancestral groups

This presentation will impact the forensic community and/or humanity by informing the community of the features in the fetal/newborn human skeleton that are disparate between ancestral groups, but to identify these features requires sub 0.1 millimeter accuracy in analysis.

This presentation is designed to inform the attendee of morphological and metric research to determine the validity of specific features in fetal/new born skeletal elements that may be used for determining ancestry. The attendee will obtain knowledge that the metric analysis applied in this study was at a too gross metric level to capture the subtle morphological differences that would determine ancestry in the human fetal/new born skeleton.

In the adult human skull, visual and metric assessment can often determine ancestry. Similar observations in the infant and sub-adult cranium have been attempted in the past with varying and usually ambiguous results. Previous observations during other research with the National Museum of Natural History (NMNH) fetal collections has identified that features of the maxilla, occipital bone and costal rib were visually disparate between individuals identified as White versus Black. In the maxilla, the nasal aperture appeared to be broader and the entire height of the maxilla is lower in Blacks. In the occipital, the alae on the lateral inferior portion of the squamosal area were more obvious in Blacks, the angle of the squamosal region and the basal region was more pronounced in Blacks, and the length of the basal section was longer in Blacks (associating with the longer and flatter basal section of the occipital as seen in Black adults). In the ribs, the shape of the costal end of the rib was more oval in Blacks and more round in Whites.

All individuals with a maximum left femoral length greater than 70.0 mm and less than 91.0 mm were evaluated for this analysis. The resulting total sample of 67 individuals was acquired for the four sub-groups: 25 Black males, 16 Black females, 11 White males and 15 White females. Any individuals with obvious pathological conditions, notated congenital defects, or cause of death (which would significantly cause insult to growth and development) were excluded from the study. Both metric and morphological assessments of the maxillary, occipital and rib features were conducted to evaluate the morphological and/or metric differences with relation to ancestral identification. All metric measurements were converted into indices to diminish size effect.

The most apparent result from this study was the negative influence from the gross incremental level of measuring the minute differences in the observed features. In testing the inherent error, intra- and inter-observer variation was evaluated. Repeatability of the sub-millimeter values at the 0.01 mm level could not be achieved. Repeatability was acceptable at the 0.1 mm level. However, to accurately capture differences in features necessitates a level greater than 0.1 mm. This is not a fault in the measurer, but the methodology of the metric data capture of the morphology. Physical warping of some of the bones (due to maceration) also negatively contributed to the efficacy of this research design.

The above problem was exacerbated by the fact that as with most all studies involving sub-adult skeletal series, the results from this study are plagued by small sample sizes when divided into their sex and ancestry groups. The results from this study cannot provide reliable assessment for ancestry identification since no tests of significance can be administered. However, from the produced index means, there is a consistent trend in the shape of the costal end of the rib with relation to ancestry that agrees with the morphological expectations.

As an effort to avoid the measuring and repeatability problems, a preliminary investigation using 3D laser surface scanning of the maxilla and occipital is ongoing and at present has produced promising results.

Human Fetal Collections, Ancestry, Morphological Analysis

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