H17 Ontogeny of Femur Subtrochanteric Shape: Implications for Determining Ancestry Using the Platymeric Index

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The objectives of this study are to examine changes in proximal femur diaphyseal shape during growth and development, determine the proximate causes for the patterns of change, and evaluate the usefulness of proximal femur shape in discriminating between Native American and American Black/White subadult femora. Attendees will learn about changes in femur subtrochanteric shape during growth and development and the validity of the platymeric index in the estimation of ancestry from human subadult and adult skeletal remains.

This presentation will impact the forensic community and/or humanity by demonstrating how femur subtrochanteric shape develops and that the platymeric index can be successfully used to distinguish between Native Americans and American Blacks/Whites in subadult skeletal remains greater than six years of age.

Gill and colleagues have suggested that subtrochanteric shape may be established early in life, and therefore the platymeric index (PI) may be useful for assessing ancestry in subadults. In this paper, the author examines changes in proximal femur diaphyseal shape and size during growth and development, and discusses the implications of the results to the validity of estimating ancestry in subadult (immature) skeletal remains.

Femur subtrochanteric anteroposterior (AP) and mediolateral (ML) diameters and diaphyseal length were obtained for 74 Native American, 17 American Black, and 50 American White subadult femora. Individuals used in the study range in age from birth to 18 years. Left femora were preferentially used, but the right femur was used if the left was absent or damaged. Since sex is difficult to estimate from subadult skeletal remains, males and females were pooled. Previous studies have shown no significant differences in subtrochanteric shape between adult American Blacks and American Whites, so they were pooled as a single group.

Changes in femur subtrochanteric shape (PI) and diameters (AP and ML) were examined by age for each of the samples. The results show that the PI decreases or becomes more platymeric from birth to about five years of age and then generally levels off in both groups. Therefore, the author examined subadults less than five years old and subadults six years old and greater separately. This second analysis shows a significant negative correlation between PI and age in subadults five years and under in both groups, but the changes in the PI are more noticeable in Native Americans (slope = -0.03, r^2 = 0.33) than in American Blacks/Whites (slope = -0.02, r^2 = 0.10). The more noticeable change in Native Americans is expected since they are generally more platymeric as adults. After the age of five years there is little change in the PI, except for a possible increase associated with the adolescent growth spurt (slope = 0.001 and r^2 = 0.005 for Native Americans; slope = 0.002 and r^2 = 0.009 for American Blacks/Whites).

An examination of the subtrochanteric dimensions reveals the proximate causes for the differences between younger and older subadults and between Native Americans and American Blacks/Whites in proximal femur diaphyseal shape. Between birth and five years of age the ML dimension increases more rapidly than the AP dimension in both groups. However, the difference is again more dramatic in Native Americans. That is, differences in the rate of growth between AP and ML dimensions is greater in Native Americans (AP slope = 1.60, r^2 = 0.74; ML slope = 2.32, r^2 = 0.81) than in American Blacks/Whites (AP slope = 1.92, r^2 = 0.88; ML slope = 2.24, r^2 = 0.81). This same pattern continues after the age of five but at a greatly reduced rate. In individuals over five years of age, the AP and ML dimensions increase in size with age at approximately the same rate in Native Americans (AP slope = 0.72, r^2 = 0.63; ML slope = 0.59, r^2 = 0.53) and American Blacks and Whites (AP slope = 0.69, r^2 = 0.46; ML slope = 0.66, r^2 = 0.44).

The results of this study demonstrate that the adult shape of the proximal femur is established relatively early in life – probably shortly after the achievement of a mature gait pattern. The proximate cause for this early establishment of adult shape is that between birth and five years of age the proximal femur diaphysis grows more rapidly along the ML plane compared to the AP plane, especially in Native Americans. However, after the age of five, growth occurs more equally in the two planes. The results of this study also make evident that the PI can be used to distinguish between platymeric Native American femora and more eurymeric American Black/White femora in subadults over the age of six years. However, the results also show that subadults, like adults, exhibit great variation within groups, probably due to environmentally induced biomechanical stress placed on the femur. This variation should be considered when using only the PI to determine ancestry in medicolegal investigations.

Forensic Anthropology, Platymeric Index, Ancestry

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