H18 Ancestry Estimation Using the Femur: A Pilot Study

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After attending this presentation, attendees will understand the utility of metric analysis of the femur in the estimation of ancestry.

This presentation will impact the forensic community by assisting with the ancestry estimation of unidentified human remains.

Estimation of ancestry is an important part of the creation of a biological profile for unknown skeletal remains. As techniques for ancestry estimation have primarily focused on the cranium, reliable methods using postcranial elements are both few in number and underutilized. Craig (1995) presented a method of ancestry estimation utilizing measurement of the intercondylar shelf angle from radiographs. While this study presents highly accurate classification rates, Berg et al. (2007) found statistically significant differences for intra- and inter- observer error using this method, placing its reliability in question.

Craig (1995) states that intercondylar shelf angle correlates with intercondylar notch height, with an acute angle corresponding to a higher notch height and an obtuse angle corresponding to a lower notch height. Baker et al. (1990) investigated the determining power of intercondylar notch height, producing accuracy rates between 76.92% and 82.5% using sectioning points. In addition to adapting measurement of intercondylar notch height from Baker et al. (1990), Gill (2001) also describes differences in femoral platymeria and torsion (evaluated from measurements of subtrochanteric diameter and maximum head height) that are potentially useful in the estimation of ancestry.

In order to examine the validity of the femur as an estimator of ancestry using a suite of measurements designed to incorporate all potential variation, a sample from the William M. Bass Donated Skeletal Collection at the The University of Tennessee consisting of 36 individuals (10 white males, 10 black males, 10 white females, and 6 black females) was selected. Ten measurements designed to assess the intercondylar notch, variation within the distal femur, platymeria, and torsion were taken from the left femur of each individual.

Analysis was then conducted to determine the measurements producing the most statistically significant differences between the groups used in this pilot study. Based on regression analysis in NCSS (NCSS LLC) five measurements were selected in order to conduct linear discriminant analysis on the data. For females the measurements selected were intercondylar notch height, medial condyle width, lateral condyle width, transverse subtrochanteric diameter, and epicondylar breadth, while for males the measurements selected were intercondylar notch height, medial condyle width, maximum head height, antero- posterior subtrochanteric diameter, and epicondylar breadth. Preliminary results of linear discriminant analysis in SAS 9.1 (SAS INSTITUTE) using these measurements indicate cross-validated accuracy rates of 90% for males and 100% for females.

Based on the preliminary findings of this pilot study the femur appears to be of valid use in the estimation of ancestry and warrants further study.

References:

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Femur, Ancestry, Forensic Anthropology

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