A7 Metric Variability in the Femur and Patella: The Potential for Ancestry Assessment

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Learning Overview: After attending this presentation, attendees will understand the potential of femur morphology for ancestry assessment between European and African individuals.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a new method for ancestry estimation that could increase the chance to sort candidates for identification, even in highly fragmented skeletal remains.

The estimation of ancestry is a key attribute—and often the most difficult—of biological identity to be determined by forensic anthropologists in the examination of unknown skeletal remains.[1,2] Numerous approaches have been proposed, most focusing on the variations in cranial morphology among different geographic groups.[3-5]

Currently, ancestry assessment based on morphoscopic traits of the skull relies on a subjective trait list and observer experience.[6-9] Moreover, the wide range of possible taphonomic alterations and preservation conditions encountered in forensic materials can affect the availability of some skeletal elements, increasing the challenge of the analysis.[10]

Several attempts to estimate ancestry from postcranial elements have also been proposed, even though they are less commonly applied in the forensic context.[2] These methods rely mainly on differences in the anterior diaphyseal curvature and intercondylar shelf angle of the femur.[11-13] In addition, the dimensions and geometry of the proximal femur have gained some attention as potential indicators of ancestry.[14-16]

This study analyzed 60 individuals, 26 African Americans (13 males and 13 females) and 34 Caucasian Americans (16 males and 18 females), from the Terry Collection housed at the Smithsonian Institute in Washington, DC. A total of 12 measurements were taken from each individual. These were on the distal end of the femur and on the patella in order to evaluate differences in the joint morphology between the two population groups.

Student's *t*-tests were run for each measurement to check if measurements from the left and right sides could be pooled together. African American males exhibit no significant difference between the left and right side; therefore, measurements were pooled together. African American females exhibit significant difference for two measurements of the femur, while Caucasian Americans exhibit significant difference for one measurement in male and female individuals.

Linear analyses were performed for the groups that could be pooled to determine the sets of data useful for binomial logistics regression for ancestry prediction. A total of nine measurements (six describing the femur for males and three describing the femur and patella for females) have been selected for regression prediction; these measurements demonstrate a percentage of correct prediction ranging from 56.4% to 70.9% in the male sample and from 67.2% to 74.5% in the female sample. All statistical analyses were performed by IBM® SPSS Statistics v.24.

The goal of this project is to identify the presence of metric variation in the human femur and patella between African and European population groups; the results obtained provide regression formula with encouraging predictive values, demonstrating the need of further analysis on a larger sample involving both skeletal collections and data from living individuals.

In addition, this research demonstrates the potential forensic applications of this new methodology for ancestry estimation even in commingled and highly fragmented unknown skeletal remains.

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