



Physical Anthropology Section – 2007

H61 Morphological Variation of the Human Knee: Implications for Sex and Ancestral Designations

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The goal of this presentation is to present to the participant of the results of analyses designed to describe the observed variation in the human knee joint based on age, sex and ancestry. The attendee will learn of the trends in morphological variation of the knee and the implications for both the forensic and medical communities.

This presentation will impact the forensic community and/or humanity by demonstrating the utility of the observed variation found in this analysis of the knee joint may be used to differentiate between living populations allowing sex and ancestral designations to be made in a forensic context.

The clinical literature has noted variation in the knee joint, for the purposes of knee related surgeries, between male and female individuals of African and European ancestry. This observed variation is critical to pre-surgical planning for repair and or implantation of artificial devices. Similarly, these authors (Waxenbaum et al. 2006) highlighted significant variation in the intercondylar eminence length of the proximal tibia which was attributed solely to population (evolutionary ancestry) and not found to be influenced by either sex or age. This presentation expounds upon previous analyses in order to determine whether other factors of size and/or shape of the distal femur and proximal tibia correlate to the population variation in the knee previously detected.

Eleven measurements (five of the distal femur; six of the proximal tibia) were added to the two measurements for each individual from the previous analysis for a total of thirteen measurements. Four populations of individuals were analyzed - (all material used in this analysis is housed at the National Museum of Natural History, Smithsonian Institution) Terry White (n = 94), Terry Black (n = 100), Eskimo and Aleutian populations from Alaska (n = 201), and a population of Arikara from South Dakota (n = 120). Individuals were sampled from both sexes and were separated into "older" and "younger" categories for age analysis given the archaeological nature of the Alaska and South Dakota remains.

The original intercondylar eminence data were re-analyzed including a small population of male, Chinese individuals (n = 51) and the previously detected trends held; neither sex nor age made a significant difference in the length of the proximal tibial eminence. However, population remained a significant factor ($P < 0.001$). When the eleven new measures of the proximal tibia and distal femur were analyzed similar trends emerged. While all new measurements displayed a significant ($P < 0.001$) population effect they also revealed a significant ($P < 0.001$) sex effect. Eight of the eleven measures additionally exhibited a significant population-sex interaction ($P < 0.050$).

Thus, these new data the gross morphology of the knee are dependent on within population sex differences and overall differences between populations.

While a direct explanation of this variation cannot be pinpointed, physical anthropology often highlights the morphology observed among diverse ancestral populations in terms of size, shape and proportionality. The authors postulate a combination of all of these factors, throughout the course of human evolution, has caused the functional change in knee joint highlighted in this analysis. The utility of the observed variation may be used to differentiate between living populations allowing sex and ancestral designations to be made in a forensic context.

Knee, Population Variation, Metric Analysis