H72 The Condyle Connection: Forensic Implications for the Association Between the Condyles of the Femur and Tibia

Erin B. Waxenbaum, PhD, 1810 Hinman Avenue, Evanston, IL 60208; and Kelsea Linney, BA*, Northwestern University, 1810 Hinman Avenue, Evanston, IL 60208*

After attending this presentation, attendees will have observed the results of comparisons between the condyles of the distal femur with those of the proximal tibia for a given individual as well as the developed predictive formula which have practical applications for the medical community, archaeological research, and forensic casework.

This presentation will impact the forensic science community by providing an analysis of the relationship and correlation between the individual skeletal components of the functional unit of the knee.

The knee is one of the most functionally important and largest joints in the body. Previous research has investigated the distal femur and proximal tibia with regards to sex assessment, ancestry and morphological differences (Waxenbaum et al., 2007), but the relationship among the condyles specifically has not been addressed. Given the robusticity with which these components of the lower limb survive in both archaeological and mass disaster scenarios, this investigation into the degree of their association is particularly important.

The populations examined include segments of the Terry White (n=94) and Terry Black (n=100) anatomical collections, a component of the South Dakota Arikara (n = 120) and Native Alaskan groups (n = 201) (all remains included in this analysis are housed at the National Museum of Natural History, Smithsonian Institution). 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. Measurements of the left medial and lateral condyles of the distal femur and proximal tibia were taken on all individuals and compared through correlations analysis, Tukey’s procedure and reduced major axis regression.

The present research found that the medial and lateral condyles of the proximal tibia and the distal femur show a statistically significant relationship across sex (p<0.0001) and ancestry (p<0.0001) for all components compared, and for age (p<0.0299) in three out of four comparisons. Insight from Tukey’s analysis highlighted significant, specific variation between the four ancestries. Native Alaskan populations were distinct in femoral condylar surfaces from all other populations but indistinguishable from Terry White individuals for tibia condylar measurements. Terry White and Black groups could not be statistically separated in all analyses given the present sample. Additionally, archaeological remains (Arikara and Native Alaskan remains) could be significantly separated from modern, anatomical specimens (Terry Whites and Blacks) in three out of the four condylar surfaces compared.

Through reduced major axis regression, a series of 15 equations were developed that were able to predict the size of the opposing bone’s condyle. The equations are general and specific to age, sex, and ancestry. The value of this observed variation is its ability to differentiate individuals of diverse populations or identify sex in mass disaster scenarios where a large number of decedents may be highly fragmented and/or commingled. In addition, the equations could be employed in a clinical setting to improve the fit of knee prosthesis during total knee arthroplasties. This would help reduce lateral over- and under- hang, correcting improper fitting prosthesis, reducing discomfort and increasing flexibility for the patient. The results of this research provide an invaluable addition to forensic mass fatality recovery and identification as well as insight into skeletal variation for both clinical and anthropological research.

Knee, Condyles, Mass Fatality

 ** Presenting Author*