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3D GEOMETRIC MORPHOMETRIC ANALYSIS OF THE TIBIAL PLATEAU: A STUDY OF SEXUAL DIMORPHISM AND POPULATION SPECIFIC VARIATION

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Abstract

Sexual dimorphism is one of the most frequently studied aspects of modern human variation, however, most of these studies focus on the skull and pelvis. Long bones have also provided excellent results for determining the sex of an individual, but population specific variation and potential remodeling due to outside forces during life must be considered. Additionally, activity level may affect the level of sexual dimorphism present in the population. Use of the tibia and femur are most common, and many studies focus on size and shape using metric measurements.

This study uses 3D geometric morphometrics to examine the shape and curvature of the articular surfaces of the tibial plateau of 200 individuals collected from the National Museum of Natural History. Individuals had similar activity levels and were divided into Caucasian and African American groups. Each subgroup had 50 individuals (Caucasian female, Caucasian male, African American female, African American male). I hypothesized that there would be statistically significant variation within populations (between males and females in the same population) and between populations (between individuals of the same sex in different populations). To determine whether one articular surface varied more strongly than the other, analyses were run on each individual articular surface and then on both surfaces combined.

Results for all analyses were highly significant with one exception: the lateral articular surface of African American females and Caucasian females. All other analyses showed clear variation between the groups and discriminant function results were consistent with, and in some cases exceeded, the accuracy determined by previous studies. The success of this method of analysis allows for an expanded study of variation across multiple populations and examination of how activity level affects expression of sexual dimorphism in populations.