H74 Regional Variation of the Proximal Femur in the United States: Analysis of Data From NHANES III

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After attending this presentation, attendees will understand the impact that regional variation has on the morphology of the proximal femur and the expression of sex and group differences in the United States.

This presentation will impact the forensic science community by providing an alternative means of studying the proximal femur through the use of data from living populations to identify factors relating to regional, group, and sex variation.

The femur is one of the most studied bones of the appendicular skeleton. A large body of published works has accumulated over the decades with information concerning major aspects of the biological profile. Anthropologists have focused on the determination of age, sex, ancestry, stature, and secular change by analyzing traditional measures from the femur. The present study contributes to this literature by testing the hypothesis that regional variation in the United States has a strong influence over proximal femur morphology, which may affect identification and clinical practice. To test this hypothesis, the present study utilizes hip geometry data (Beck, 2002) from the National Health and Nutrition Examination Survey (NHANES) III database made available to researchers by the Center for Disease Control and Prevention. All the data used in the present study were collected by using a hip structural analysis program and a bone mineral density and structural geometry methodology. The selected sample for this study consists of 13,006 individuals (6,415 males and 6,591 females). All data were organized into four major regions: Northeast, Midwest, South, and West and represent non-Hispanic whites, non-Hispanic blacks, and Mexican Americans.

Nine measurements, in centimeters, collected by a hip structural analysis program provided the basis for conducting the present study. The measurements are: hologic femur neck width; femur neck shaft angle; femur neck length; narrow neck width; narrow neck endocortical diameter; intertrochanteric width; intertrochanteric endocortical diameter; femoral shaft width; and femoral shaft endocortical diameter. To test the proposed hypothesis, a MANOVA first tested the main effects of interaction for region, group affiliation, and sex. A canonical discriminant function analysis was then performed on the entire sample for sex, on males for group and regional variation, and on females for group and regional variation. Significance was observed at the .05 level in all of the analyses.

According to the MANOVA procedure, regional, group, and sex differences are statistically significant. Moreover, the MANOVA procedure shows statistical significance in the interaction between region and group, but no statistical significance in the interaction between region and sex. The discriminant function analyses support the results of the MANOVA procedure. The discriminant function analysis for sex suggests that sex can be identified with 88% accuracy when all groups and all regions are pooled together. The most meaningful variables for sex identification are intertrochanteric width, narrow neck width, and intertrochanteric endocortical diameter. Group affiliation affects the pattern of sexual dimorphism, but region has no effect.

The male discriminant function analysis suggests that group affiliation can be identified with 56% accuracy when region is a factor. In CAN1, narrow neck endocortical diameter and intertrochanteric endocortical diameter account for group differences in the sample. In CAN2, femur neck length and femoral shaft width account for regional differences. Similarly to the male analysis, the female discriminant function analysis suggests that group affiliation can be identified with 56% accuracy when region is a factor. In CAN1, intertrochanteric

endocortical diameter and narrow neck endocortical diameter account for group differences in the sample. In CAN2, narrow neck width and femoral shaft width account for regional differences.

The results of the present study are consistent with previous works by demonstrating that regional variation has a strong effect in the morphology of the proximal femur. While the overall pattern in sexual dimorphism is not affected by region, the pattern of group affiliation is, which in turn, influences sex variation. In both males and females, the sample breaks down according to group affiliation. However, the pattern of group affiliation is determined by regional membership. This study demonstrates the importance of using data from living populations to create biological profiles of skeletal remains. The creation of biological profiles is not possible without an understanding of variation from living populations.

Proximal Femur, Sexual Dimorphism, Group Affiliation

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