A95 A Geometric Morphometric Comparison of Pelvic and Cranial Sexual Dimorphism

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After attending this presentation, attendees will understand how sexual size and shape dimorphism compares in the human os coxae and cranium, including which shape changes contribute the most to sex differences.

This presentation will impact the forensic science community by providing cross-validated correct sex classification rates for the os coxae and cranium and demonstrating to forensic anthropologists which of the two elements provides the most reliable sex estimation when case results may be contradictory.

In humans, the os coxae and the cranium are commonly referred to as the most sexually dimorphic regions of the skeleton and thus are often used to estimate the sex of individuals in a variety of physical anthropology subfields, including paleoanthropology, bioarchaeology, and forensic anthropology. Although there are numerous studies analyzing either pelvic or cranial sexual dimorphism, these studies utilize various populations, samples, sample sizes, types of data, methods, or statistical analyses, making a direct comparison between the resultant dimorphism values invalid. Only one study was found in which pelvic and cranial dimorphism was analyzed using a single sample, but it only compared non-metric sex estimation results, which are known to be somewhat subjective. The goal of this study was to use landmark data and geometric morphometric analyses to compare sexual size and shape dimorphism in the os coxae and cranium in a single sample. The use of a single study sample for both analyses means that the obtained sex classification results are directly comparable and will provide forensic anthropologists with information regarding the reliability of these two elements in sex estimation methods.

Forty-two landmarks from the cranium and 12 landmarks from the os coxae were digitized using a MicroScribe® on a sample of 113 United States Black adults (aged 17 years to 70 years) from the Hamann-Todd Osteological Collection. Following a Procrustes superimposition, principle component and discriminant function analyses were used to assess and compare the degree of sexual shape and form (combined shape and size) dimorphism present in both skeletal regions. Univariate analyses were performed to evaluate which specific shape changes were contributing the most to the sex differences. Centroid size was used to assess sexual size dimorphism.

The results of the shape, form, and size analyses all indicate that the os coxae is more sexually dimorphic than the cranium. The discriminant function analysis performed on the os coxae shape variables resulted in a cross-validated correct sex classification rate of 99.1%, compared to 84.1% in the cranium. Including size in the shape analyses (i.e., form) and analyzing size independently (i.e., centroid size) did not increase sex classification rates, indicating that sex differences in these elements occurs primarily in shape. The geometric morphometric analyses confirmed that relative pubis length, sciatic notch breadth, and subpubic concavity were the most important shape variables in pelvic dimorphism. In addition, os coxae height relative to ilium breadth also contributed to sex differences. In the cranium, the geometric morphometric analyses revealed sex differences in facial height, vault breadth, cranial base flexion, nasal width, and glabellar prominence.

As this study uses a single sample to analyze sexual dimorphism in the os coxae and cranium, it eliminates many extraneous variables (e.g., sample and method differences) and allows a direct comparison between the skeletal regions. Results confirm that the os coxae is significantly more dimorphic than the cranium; thus, when assigning sex to an unknown skeleton, forensic anthropologists should rely more heavily on pelvic morphology. Geometric morphometric shape analyses conducted on the os coxae landmark data can discriminate between the sexes with up to 99% accuracy and provide an objective method to quantitatively analyze traditional non-metric sex traits.

Sex Estimation, Os Coxae, Cranium

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