H30   New Linear Measurements for the Estimation of Sex From the Human Sacrum

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The goal of this presentation is to inform attendees about six new measurements of the sacrum that were proven to be the most useful for adult sex estimation through a discriminant function analysis.

The presentation will impact the forensic science community by demonstrating an accurate method of adult sex estimation from the sacrum through discriminant function analysis using new linear measurements derived from three-dimensional inter-landmark distances.

The accurate estimation of sex is crucial to the development of a biological profile for a set of unidentified skeletal remains. Previous metric and non-metric methods of sex estimation utilizing the sacrum have demonstrated the potential of this skeletal element for such an assessment; but classification rates derived from an appropriate sample are unknown. This research provides new linear measurements of the sacrum from a large sample that were shown to be the most useful in the estimation of sex through a cross-validated discriminant function analysis.

A geometric morphometric analysis of the sacrum was previously conducted (Passalacqua et al. 2010) in order to capture the sexual dimorphism visually apparent in this skeletal element. This method was able to estimate sex with an 85.75% cross-validated accuracy (89.40% for males, 82.10% for females). Unfortunately, the use of geometric morphometric analysis in forensic anthropology casework is often impractical due to differential preservation, skeletal trauma, or lack of equipment. Due to these factors, the development of new two- dimensional linear measurements of the sacrum will allow for a wider application of this method. Thus, the current study utilizes previous geometric morphometric sacrum data to determine the most useful linear measurements for sex estimation (Passalacqua et al. 2010).

A sample of 163 adult sacra (85 males, 78 females) was collected from the Hamann-Todd Collection (Cleveland Museum of Natural History). Twenty-three three-dimensional (3D) landmarks were developed and collected on each individual using a digitizer. Inter- landmark distances were then extracted from the 3D data providing 253 measurements for each sacrum. This method of extracting linear measurements allows for a vast amount of data to be collected in a short amount of time and in addition creates new measurements which may not have been otherwise analyzed. These measurements were analyzed

through a forward step-wise (F = 0.05 to enter, F = 0.10 to remove) discriminant function analysis. This discriminant function analysis selected six measurements for estimating biological sex. These measurements focus on the alae especially in relation to the promontory. This suggests the majority of the sexual dimorphism exhibited in the sacrum involves this area and effective sex estimation is possible with fragmentary sacra as the overall size, shape, and curvature were not necessary. Results indicated an 89.0% cross-validated accuracy of the correct classification of sex (males were correctly classified at 89.4% and females were correctly classified at 88.5%). As noted above, this is slightly higher than the classification rate with 3D geometric morphometrics and these inter-landmark distances can be measured using standard sliding calipers allowing for this method to be easily utilized in the field or laboratory without access to a digitizer.

Sex Estimation, Sacrum, Discriminant Function Analysis