H95 Metric Sex Determination From the Mandible

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The goal of this presentation is to examine patterns of metric sexual dimorphism within the mandible, and to provide a simple, accurate, and reliable means of sex determination.

This presentation will impact the forensic community by providing an updated method to determine biological sex from unknown human skeletal remains using a contemporary sample.

Assessing the biological sex of an individual is one of the first steps that the forensic anthropologist is faced with when constructing a biological profile. The designation of sex is of utmost importance because other aspects of the biological profile, such as stature, age and ancestry, rely on an *a priori* knowledge of the individual's sex. It is widely known that the pelvis is the most accurate estimator of sex, followed by the cranium. However, these elements are not always present for analysis due to incomplete recovery or taphonomic events. Additionally, even if the elements are present, many of the diagnostic aspects of the bones are often destroyed due to animal scavenging or weathering processes. As such, other skeletal elements must be evaluated for their usefulness in differentiating between the sexes.

The mandible is one of the densest bones of the skeleton and therefore is one of the elements most likely to survive in an archaeological or forensic setting. While several metric and non-metric traits of the mandible are often cited as accurate indicators of sex, many of these values and traits have not been rigorously tested. A poster given at the 59th annual meeting of the American Academy of Forensic Sciences presented the results of a study on the utility of the mandibular angle (degree of rami inclination) and its corre- sponding, oft-cited 125° sectioning point for sex determination of unknown individuals. Contrary to what is often taught in classrooms and presented in introductory textbooks, this study showed that the mandibular angle is neither an accurate nor reliable indicator of sex (Zambrano et al., 2007). The current study seeks to elaborate on last year's conclusions by finding an alternate metric means to quickly and accurately determine sex using the mandible.

The study sample is composed of mandibular metric data from forensic cases compiled by two separate laboratories. The Florida data are derived from contemporary individuals from Florida and surrounding states processed at the C.A. Pound Human Identification Laboratory at the University of Florida (n = 171). The Forensic Data Bank sample is composed of cases analyzed and submitted to the University of Tennessee by forensic anthropologists from across the country (n = 490). A random sample of 150 individuals was held out of the combined forensic dataset for use as a test data set.

Nine linear mandibular measurements (Moore-Jansen et al. 1994) from the remaining combined forensic sample (n = 511) were analyzed using stepwise linear discriminant function analysis, in an attempt to identify which dimension(s) of the mandible provided the greatest discrimination between the sexes. Among the nine measurements, bigonial breadth, ramus height, and chin height were chosen, based on partial R-square values, as the variables producing the greatest separation between sex groups. A linear discriminant function was created using the aforementioned measurements. Re-substitution and cross-validation results accurately sexed the mandible 82 – 87% of the time. Verification of the ability of the three variable function to discriminate was further tested on the hold-out test data and found to accu- rately sex individuals in 82% of the cases.

These results are consistent with previous linear discriminant function studies of the mandible such as Giles (1964) with an accuracy of 85% and Steyn and Iscan (1998) with an accuracy of 82%. However, the current study has a much larger sample size than the previous two studies and is comprised of contemporary US forensic cases of mixed ancestry. As such, the study and test samples are more similar to those that are encountered in routine forensic casework. Over the years, sex estimation using the mandible has proven difficult. This study provides an alternate means to accurately and quickly determine the sex of an individual using three mandibular measurements.

References:

1 Giles E. 1964. Sex determination by discriminant function analysis of the mandible. Am. J. Phys. Anthrop. 22: 129-136.

2 Moore-Jansen PH, Ousley, SD, and Jantz, RL. 1994. Data Collection Procedures for Forensic Skeletal Material. 3rd ed. University of Tennessee Forensic Anthropology Series, Knoxville, Tennessee.

3 Steyn M, Iscan MY. 1998. Sexual dimorphism of the crania and mandibles of South African Whites. 98: 9-16.

4 Zambrano CJ, Parr NM, Freas L, Falsetti AB, Warren MW. 2007. Evaluation of the mandibular angle as an indicator of sex. Poster presented at the 59th annual meeting of the Academy of the Forensic Sciences. San Antonio, TX.

Mandible, Sex Determination, Linear Discriminant Function

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