



Physical Anthropology Section – 2005

H63 An Evaluation of Racial Differences in the Human Mandible Using Discriminant Function Analysis

Marie Danforth, PhD*, University of Southern Mississippi, Department of Anthropology and Sociology, 118 College Drive, #5074, Hattiesburg, MS 39406

After attending this presentation, attendees will understand the potential value of mandibular measurements in the assessment of ancestry in the human skeleton, specifically focusing on discriminant function analysis.

This presentation will impact the forensic community and/or humanity by demonstrating that the determination of race from the skeleton is one of the most difficult areas of assessment in forensic anthropology. This presentation will provide another technique in such assessment using a bone that is often well preserved.

As most in the forensic community are aware, determination of ancestry using the human skeleton is often challenging. The mandible is not traditionally regarded as featuring many reliable indicators of race with only a few non-metric differences, such as the more pointed chins seen in whites, having been noted in discussions of racial assessment (Rhine 1990). Researchers, however, have observed that at times entry of ascending ramus data into Fordisc 2.0 analysis changed the racial assignment of a particular skull. Although this is likely attributable to the small sample sizes of the referent populations used in generating the statistical functions employed, it also suggests that a comprehensive study of mandibular metrics for blacks and whites might prove useful. The mandible would be an especially valuable bone since it is often well preserved. Consequently, such an analysis was undertaken, using the Terry Collection at the Smithsonian Institution to determine which parts of mandible, if any, are diagnostic in assessment of ancestry.

The Terry Collection is composed of complete skeletons from medical school cadavers dating to the first half of the 1900s. As a result, individuals are of known sex, race, and age. Some 211 mandibles were evaluated with sample selection being severely limited by extensive antemortem tooth loss. It was desired that individuals have at least three of the six molars present to minimize the effects of loss on ramus morphology. The final sample was distributed as follows: black males – 68; white males – 68; black females – 33; and white females – 14. An additional 28 individuals composed a control sample. Eighteen measurements were taken using sliding calipers or a mandible board. Most measurements were standard for the mandible, although several concerning dental arcade dimensions were created for this project. Data were evaluated using stepwise discriminant function analysis in SPSS with groupings comprised of the entire sample, only males and only females.

The variables that statistically entered into the three functions were consistently drawn from the same set: M2-prosthion length, bigonial breadth, minimum ramus breadth, alveolar length, and ramus height. All of the functions had Eigenvalues greater than 1.0, canonical correlations over .700, and Wilk's lambda values less than .500. Classification success rates were 75.3% for the entire sample (BM, BF, WM, WF), 86.2% (males alone), and 93.0% (females alone). When the discriminant functions were applied to the control sample, the success rates were 72.0%, 89.5%, and 87.5%, respectively.

These results suggest that consistent metric differences are present in mandibles between whites and blacks, although the diagnostic features do not seem to cluster in one area of the bone (i.e. the ramus or the dentition). The similarity in variable selection for the functions for each sex was surprising, suggesting that racial differences are indeed being detected. It should be noted, however, that the classification results were much better when the sexes were separated. Although these findings are very encouraging, further work still needs to be conducted, especially with a larger sample size of white females. It is also important that the role of antemortem tooth loss be more directly addressed since individuals evaluated by forensic anthropologists often suffer from extensive dental pathology.

Mandible, Measurements, Ancestry