H82 Discriminant Function Analysis as Applied to Mandibular Metrics to Assess Population Affinity

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After attending this presentation, attendees will be familiarized with the results of a study examining the metric characteristics of the mandible and their ability to predict ancestry.

This presentation will impact the forensic community by offering another assessment of the mandible as a reliable indicator of population affinity for use in forensic casework.

Forensic anthropologists tend not to rely heavily on mandibular metric data to determine population affinity for several reasons. First, the most widely available comparison groups are usually limited to U.S. Whites and Blacks. Second, when other populations are available for comparison, the sample sizes are relatively small and are not forensically relevant to U.S. casework. Third, anthropologists are more familiar with cranial metrics rather than those of the mandible. Therefore, there is a need to develop reliable formulae for deriving population affinity based mandibular metric data. This paper examines the ability to correctly classify an unknown indi- vidual using mandibular metrics through discriminant function analysis using populations that are forensically relevant in the United States.

The study concentrates on individuals from approximately ten different populations that include American Whites and Blacks, Cambodians, Viet- namese, Central American Hispanics, Nubians, and Native Americans. The total sample size is in excess of 1000 individuals; all individuals are assumed to have late 19th to 20th century birth years, except for certain Native American groups and the Nubians. Eleven measurements were collected for each mandible in the study; eight were standard, one was a modified standard measurement, and two were newly defined. The standard measurements have been defined numerous times and the definitions given in Moore-Jansen *et al.* (1994) are followed. The two new measurements are the mandibular body breadth at the M2/M3 junction and the dental arcade width at the third molar. The modified measurement is the mandibular body breadth at mental foramen.

Step-wise linear discriminant function analyses using the Mahalanobis D^2 distance statistic were undertaken on the data. These analyses concen- trated not only on two populations at a time, but also up to ten group evalu- ations. Male only and female only comparisons as well as pooled sex comparisons were undertaken; many analyses used males only due to rela- tively small female sample sizes in certain populations. When present, missing data were estimated using multiple linear regression models, by population. Each analysis was cross-validated using a leave-one-out method for accuracy assessment. Frequently, the measurements of the mandibular angle and bicondylar width did not enter into the final discriminant functions.

A two population comparison between American Whites and Blacks, sexes pooled, yielded a cross-validated accuracy rate of 85% using four variables. Other two group comparisons for males only yielded cross-validated accuracy rates between 83% and 94%. Nearly all three population comparisons, males only (for example American Whites, Blacks, and Cambodians) yielded cross-validated accuracy rates between 71% and 75%. Several five population comparisons yielded cross-validated accuracy rates around 55%, approximately three times better than the expected accuracy if based on chance alone. Finally, all groups together yielded a 47% accuracy rate, or over four times chance alone. Interestingly, secular change also is detectable in related groups over time, such as 19th and 20th century U.S. Blacks and Whites. These results are similar to the expected accuracy rates from other discriminant function analyses involving the skull, e.g., mandibular morphology and cranial metrics. Based on these results, the use of discriminant functions to assess population affinity via mandibular metrics is argued to be a valuable tool for the forensic anthropologist.

Forensic Sciences, Mandible, Ancestry

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