H114   Ancestry Estimation in Forensic Anthropology: Geometric Morphometric Derived Data vs. Traditional Craniometric Data With Special Reference to Hispanic Crania

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After attending this presentation, attendees will learn about geometric morphometric derived data as compared to traditional cranial measurements with regard to ancestry estimation.

This presentation will impact the forensic science community by suggesting changes in standard forensic anthropology data collection protocol for improved ancestry estimation.

The term Hispanic has been used frequently in forensic anthropology literature.[1-3] The term is ambiguous when considering the genetic variation of the different national origin groups (e.g., Puerto Rico, Mexico) that comprise this designation.[4,5] Currently, little is known about the morphological variation of groups considered Hispanic due to lack of skeletal reference data. Previous research suggests that reference data with the designation Hispanic provides ambiguous classifications for estimates of ancestry using traditional cranial measurements or Inter-Landmark Distances (ILDs).[6] The ambiguous classifications are likely due to the non-population-specific nature of the data. Geometric Morphometric (GM) methods in forensic anthropology have received attention in recent years concerning the potential to improve ancestry estimations due to the focus on shape independent of size.[7,8] The purpose of this presentation is two-fold; to test whether GM derived shape and size variables perform better than cranial ILDs for the purpose of ancestry estimation, using population-specific data from several Hispanic groups from Mexico and Guatemala.

Due to large-scale data collection efforts at the Pima County Office of the Medical Examiner in Tucson, Arizona, and two universities in Mexico, craniometric data from positively identified Mexicans are now available. Mexicans currently comprise over 65% of the United States Hispanic population with over 35% foreign born.[9] Therefore, data used in the present analyses can be considered population-specific for the majority of Hispanics in the United States. The following groups were used in all analyses: Mexican (n=95); Guatemalan (n=71); American Black (n=61); and American White (n=247). Although Guatemalans represent a smaller percentage of the U.S. Hispanic population, the increase in migrant deaths along the United States-Mexico border from areas other than Mexico, especially in Texas, make it important to distinguish among various national origin groups.[10]

Due to small sample size, females were excluded from the current analysis. In order to test whether GM-derived variables perform better than ILDs, several Discriminant Function Analyses (DFAs) were run. Standard ILDs include those outlined in Jantz and Moore-Jansen, and additional ILDs outlined in Howells were also included.[11,12] All ILDs were imported into FORDISC® 3.1 using the custom import function and two DFAs were run, one with standard ILDs and one with Howells' ILDs, both using the stepwise variable selection procedure.[13] For the GM analyses, a total of 35 landmarks were selected to represent overall craniofacial morphology and to maximize sample size. Using MorphoJ, a Procrustes analysis was performed and principal components and centroid size were obtained.[14] The first ten principal components and centroid size were run in a DFA using SAS® 9.3 to obtain cross-validated classification rates for comparison with rates obtained from ILDs.[15]

Cross-validated classification rates using standard ILDs are 61% for Mexicans, 75% for Guatemalans, 80% for American Blacks, and 89% for American Whites. When Howells ILDs were used instead of the standard ILDs, classifications increased with 76% for Mexicans, 85% for Guatemalans, 91% for American Blacks, and 87% for American Whites. Using GM-derived principal components and centroid size, classifications are 61% for Mexicans, 58% for Guatemalans, 60% for American Blacks, and 84% for American Whites. The highest classification rates are those obtained using Howells' ILDs rather than those considered standard. Further, classification derived from GM methods are the lowest. The Howells ILDs used in the DFA include multiple angles involving basion, bregma, prosthion, and dacryon, and fractions and subtenses along the frontal bone.

These results suggest: (1) ILDs outperform GM derived data for the purposes of ancestry classification; (2) Howells ILDs outperform the currently used standard ILDs, especially for distinguishing Mexicans and Guatemalans from each other and other groups; and, (3) Mexican's and Guatemalans differ in cranial morphology, suggesting that it is possible to distinguish among national origin groups considered Hispanic. These results further suggest that it is time to revise our current, standard data-collection protocol in order to keep momentum with our constantly changing U.S. population demographics.

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