A57 Comparing Cranial Morphology in Asian and Hispanic Populations: Exploring Why Misclassification Can Occur When Using Discriminant Function Analysis

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After attending this presentation, attendees will have baseline knowledge of the similar and distinct cranial morphologies that are represented among various modern Asian and Hispanic samples.

This presentation will impact the forensic science community by providing quantification of size and shape variables of the human cranium among the aforementioned populations in an effort to elucidate why misclassification of Asian and Hispanic individuals can occur when performing discriminant function analyses between these groups.

Arguably one of the most difficult and daunting tasks that forensic anthropologists face during the construction of the biological profile, is the estimation of ancestry. The interaction between heritability and the influence of environmental factors which result in the common microevolutionary forces outlined in the literature is not a cause-and-effect relationship and thus will continuously provide research fodder for a range of disciplines that seek to examine how human populations adapt and change over time. Practitioners that work within the unique context of North America, which has high percentages of populations from all over the world and is often referred to as a genetic and biological melting pot, must be especially cognizant of these factors when estimating ancestry of unidentified individuals. Specifically, it has been reported by forensic anthropologists who operate in the American Southwest that using reference samples provided by FORDISC® 3.0 software can misclassify Hispanic individuals as representative of modern Japanese and other Asian populations.[1]

To examine the morphological overlap than can occur when attempting to estimate ancestry of Hispanic and Asian skeletons, this study employed discriminant function and canonical variate analysis to examine morphological differences and similarities among the populations sampled. Fifteen standard cranial measurements were used that represent all developmental and functional modules of the human cranium. The Asian samples used included male and female individuals from Korea (n=52), China (n=60), Vietnam (n=45), Thailand (n=109), and Japan (n=240). The University of Tennessee Forensic Databank provided the Korean and Vietnamese samples, while the Japanese, Thai, and Chinese samples were measured for this study. The Japanese samples are representative of northern, middle, and southern Japan and were collected from Sapporo University, Tohoku University, University of Tokyo, Kyoto University, Kyushu University, and University of the Ryukyus, respectively. The Thai sample was collected at Khon Khaen University and the Chinese sample was collected at Hong Kong University. Additionally, the Hispanic data (n=450) was provided by the Forensic Databank.

Results indicate that, in general, good separation between the Hispanic and Asian samples described can be achieved with discriminant function and canonical variate analysis. Specifically, while it has been found that misclassifications of Hispanic individuals occur at a higher rate among the Japanese than any other Asian population sampled, it was shown in this study that significant differences can be identified within the cranial vault. In particular, Hispanic samples were shown to be much wider within the posterior portion of the cranium, while the anterior portion of the vault were shown to be much narrower than the Japanese samples; however, considerable overlap was also found among the Japanese and Hispanic samples in many of the other cranial dimensions represented by the measurements used, indicating that misclassification is indeed easy to achieve. In regard to the other samples used, it was found that, in general, the Asian samples clustered together and were distinct from the Hispanic samples, but separation was also identified between the East Asian and Southeast Asian individuals. Morphological distinction was also identified that separates the Japanese samples from the other Asian samples in some dimensions of the cranium.

The patterns observed in this study show that morphological similarities and distinctions can be identified when comparing Hispanic samples to East and Southeast Asian populations. While overlap is observed among the Asian and Hispanic samples, there are also specific regions of the cranium, namely anterior and posterior portions of the vault, where differences are identified, particularly among the Hispanic and Japanese samples. Thus, this indicates that partitioning the cranium and using specific dimensions may increase accurate ancestry estimation. This information may provide anthropologists with a better understanding of cranial variation in Hispanic and Asian populations that may ultimately result in more accurate estimates of the biological profile and in a higher percentage of positive identifications.

Reference:

1. Jantz RL, Ousley SD. *FORDISC® 3.0: personal computer forensic discriminant functions*. Knoxville (TN): The University of Tennessee, 2005

Cranial Morphology, FORDISC®, Forensic Anthropology

Presenting Author