A59 A Geometric Morphometric Analysis of Contemporary Hispanic Populations From Mexico and Colombia

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After attending this presentation, attendees will have gained a more precise understanding of geometric morphometric analysis and its applicability to ancestry estimation in Hispanic populations.

This presentation will impact the forensic science community by illustrating that a greater degree of classification beyond Hispanic may be possible using geometric morphometric methods that provide a statistically grounded model to differentiate two Hispanic populations.

In contexts such as natural disasters, humanitarian efforts, and forensic investigations, the timely and accurate development of the biological profile is vital to the identification of decedents. An essential but problematic aspect of the biological profile is the estimation of ancestry. Geometric morphometric analyses are germane to forensic ancestry estimation because they employ a statistically sound approach, derived from W.W. Howells' well-defined landmarks that focus on craniometric shape differences independent of size; however, many of the current methods pose a challenge because the term "Hispanic" is frequently utilized to represent world-wide Hispanic populations with the untested assumption that all individuals from North, South, and Central America, and the Caribbean are skeletally homogenous.[1-3] Additionally, comprehensive studies of Hispanic populations are severely limited due to the lack of robust reference data. The continued use of unrefined methods is problematic when employed in areas where remains are likely to be of Hispanic origin. As such, this study tests the hypothesis that two contemporary populations from Latin America (Colombia and Mexico) will demonstrate significant craniometric shape variability and provides population-specific forensic ancestry estimation methods.

This study explores geometric morphometric population variation and differentiation in 422 Colombian and Arizona Migrant individuals, 18 to 102 years of age. The Colombian sample is composed of 191 individuals from the late 20th and early 21st century (University of Antioquia). The Migrant sample is composed of 231 border crossers from the Pima County Office of the Medical Examiner (PCOME) in Tucson, AZ. The PCOME reports that the majority of migrants who die along the United States-Mexico border are from Mexico, and, as such, this group will represent a contemporary Mexican population.[4] MorphoJ, a program written for geometric morphometric analyses, was used to interpret the data in order to understand shape variation between the samples.[5] A Generalized Procrustes Analysis (GPA) was performed to scale, rotate, and transform the data into a common coordinate system. Males and females were pooled together in order to maximize the sample size. Subsequently, a Canonical Variate Analysis (CVA) was run in order to maximize the differences among the groups and isolate the key features contributing to the variation.

Mahalanobis distances were produced from the CVA and indicated statistically significant differences between the Migrant group and the Colombian group ($p < .001$). The plot produced by the CVA graphically displays the separation between the Colombian and Migrant group. The results support the hypothesis that morphological differences exist between the Colombian and Migrant decedents, who are more likely Mexican nationals. Therefore, a greater level of classification accuracy beyond "Hispanic" is possible using geometric morphometric methods.

This study supports the notion that a higher level of forensic identification may be possible using a geometric morphometric approach for Hispanic populations. Both the Colombian and Migrant samples demonstrate variability in form that underscores the importance of introducing geometric morphometric methods into the forensic toolkit. Moreover, this study demonstrates that Hispanic populations are not skeletally homogenous due to unique admixtures from the three primary ancestral groups (European, African, and Native/Asian) and differing population histories. Therefore, within a statistical framework, geometric morphometric methods can derive accurate identifications by assessing ancestry in a meaningful way using the morphological variation present in the human cranium.

This research was funded by Boston University's Department of Anatomy and Neurobiology.

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Hispanic (Mexico and Colombia), Ancestry Estimation, Geometric Morphometrics

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