H27 Using Metric Analysis to Investigate Ancestral Affinity of the Mandible

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After attending this presentation, attendees will gain an appreciation of the morphometric variation of the mandible of seven distinct geographic regions. Numerous studies have examined metric landmarks of the human skull to investigate geographic differences among human populations. However, most of the research has focused on the cranium, and far fewer studies have utilized the mandible to assess variation within human populations. Previous research has established that morphological differences of the mandible exist between sexes and ancestral groups. Berg (2006, 2011) has shown that discriminant function analysis of mandibular morphology is an accurate tool for classification of individuals (including sex and ancestry).[1,2] This study utilizes discriminant function analysis, and calculation of Mahalanobis distances to further assess morphological patterns in distinct populations.

This presentation will impact the physical anthropological and forensic community by identifying the morphological differences of the mandible in distinct populations. The purpose of this study is to test the hypothesis that metric analysis of the mandible can be used to interpret ancestral relationships and thus aid in the classification of unidentified individuals.

This paper assessed metric differences of the mandible between 1,259 modern individuals. The individuals represented seven geographic groups which consisted of United States blacks (n=151), United States whites (n=166), North Eastern Asia (n=434), Eastern Asia (n=151), Southeastern Asia (n=115), Latin America (n=129) and West Africa (n=113).

The sample consisted of a combination of individual measurements compiled from the University of Tennessee's forensic anthropological database and the Hanihara craniofacial data set. The combination of datasets has not been previously utilized to address the amount of mandibular morphological variation within differing geographic and ancestral modern human groups. The mandibular measurements utilized in this analysis consisted of seven measurements as defined by Martin (1928).[3] Bicondylar breadth (CDL), bigonial breadth (GOG), height of the mandibular symphysis (GNI), corpus mandibular width (TML), minimum anteroposterior width of the ramus (WRL), and maximum ramus height (XRL). As population differences and sexual dimorphism has been described by previous studies, discriminant function analyses were run on males and females separately to assess what is driving differences among population groups in regards to the combination of the effects of the mandibular measurements of CDL, GOG, GNI, TML, WRL, and XRL.

Results of the discriminant function analyses utilizing the measurements described on the male only sample indicated that the population groups were most clearly distinct in the combination of WRL, CDL, and TML, which accounted for 65.5 % of the variance observed, the combination of GNI, WRL and negatively correlated CDL (23.3%) and GNI (9.8 %).

Centroid plots from the discriminant function analysis of males only indicated that in regards to the first combination of measurements, the Northeast Asian sample exhibited the largest averages and were distinct from East Asian and Southeast Asians samples that plotted together in the middle of the axis. The North American blacks and West African samples plotted near each other below the Asian groups. The Latin American showed a large amount of variation but mostly plotted in the middle of the axis. The North American white sample exhibited the smallest averages and plotted at the negative end of the axis. The combination of GNI, WRL and negatively correlated CDL indicated a more linear relationship, with North American blacks and West Africans exhibiting the highest means and clustering together. The Asian samples plotted together with Latin American and North American whites, which exhibited the smallest average. Centroid plots from the discriminant function analysis of females only indicated the same patterns observed in the male analysis. Observation of Mahalanobis distances grouped the North American black and West African samples together with the North American white samples furthest from these groups. The Latin American and Asian samples grouped together and exhibited distances intermediate between the North American black and white groups.

Results of these analyses confirm conclusions of previous studies in that mandibular morphology can be used to infer ancestral affinity. This study shows that metric analysis of the mandible can be used to assess intracontinental variation as seen in comparison of Northeast and Southeast Asian samples, in addition to broad ancestral categories. Further studies are required to assess the degree in which morphological variability of the mandible is affected by environmental factors, and which traits (metric and non-metric) are most susceptible to plasticity.

References:

1. Berg GE. Discriminant function analysis as applied to mandibular morphology to assess population affinity. Proceedings of the American Academy of Forensic Sciences; 2006, Seattle, WA.
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Mandible, Metric, Variation

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