H100 Examining Admixture and Secular Change in a Cranial Sample From Southern Japan

Beatrix Dudzik, MA, 3909 Briargate Avenue, Knoxville, TN 37919;and Noriko Seguchi, PhD, Kyushu University, Grad School Soc & Cult Studies, 744 Motooka, Nishi-Ku, Fukuoka City 819-0395, JAPAN*

After attending this presentation, attendees will better appreciate how cranial vault morphology has changed through time to result in the morphological complex observed in modern Japanese populations.

This presentation will impact the forensic science community by providing quantification of how the neurocranium can be used to understand population history in a specific East Asian sample, which can ultimately be used to elucidate how evolutionary processes such as gene flow and secular change can be better identified in populations that are often encountered in forensic contexts within the United States.

Results of this study will also be used to examine how discriminant function analyses using reference samples provided by FORDISC® 3.0 software can misclassify Hispanic individuals as representative of modern Japanese populations.[1]

A multitude of research exists that investigates cranial variation of prehistoric and modern Japanese populations. Previous studies that employ multivariate analyses to two dimensional cranial measurements have addressed hypotheses regarding the population history of the entire Japanese archipelago, which has mainly focused on the biological distance and relationship of the prehistoric Jomon of Japan, Eneolithic Yayoi Agriculturalists, and modern Japanese groups within the context of the craniofacial form.[2,3] While the seminal works of the last several decades have elucidated much of the population and migration history of Japan as a whole, less emphasis has been placed on the examination of skeletal samples representative of specific geographic areas and temporal continuity.

This study is one of the first to examine cranial variability utilizing the skeletal collection housed at Kyushu University in Fukuoka, Japan. This unique collection curates skeletal samples from Kyushu Island and nearby locales that are temporally representative of a nearly continuous sequence from the prehistoric Jomon culture to specimens from the 20th-century. Thus, using this temporally deep sample allows for the testing of several hypotheses that build upon recent findings that suggest the neurocranium correlates more significantly with neutral genetic traits and thus is a better predictor of population affinity.[4,5]

This study employs multivariate analyses, including principal component analysis, discriminant function analysis, and procrustes superimposition, to analyze three-dimensional coordinate data and two-dimensional linear measurements to allow for a thorough examination of the cranium in which the skeletal modules of the cranial base, neurocranium, and viscerocranium are examined congruently and separately. Eighty-five cranial landmarks were collected using skeletal samples spanning from the prehistoric Jomon and Eneolithic Yayoi agriculturalists to the Edo and recent Meiji periods, all excavated within Kyushu island or neighboring prefectures. Examination of the cranial base and neurocranium without the viscerocranium was employed to test the hypothesis that migration and gene flow events during the Yayoi period in southern Japan could be better identified than with an emphasis of facial dimensions described by previous studies. This study hypothesizes that an intermediate morphology resulting from gene flow from these distinct populations may be identifiable in the later skeletal series of the Kyushu samples when emphasizing shape and size variables of the cranial base and vault. These variables were also used to examine morphological trends evident over geographic time and space within the southern Japanese archipelago to build upon the secular change work carried out by previous studies.[6]

Results indicate that the removal of facial landmarks and concentration on dimensions associated with the vault and base suggests that skeletal samples subsequent to the Jomon and Yayoi periods exhibit cranial morphology intermediate to the parental samples. These findings lend support to the dual structure hypothesis proposed for the peopling of Japan, which posits that admixture rather than replacement occurred between the Neolithic Jomon and Eneolithic Yayoi cultures.[3] Differing results are found with the inclusion of facial variables, which makes interpretation of relationship between temporal groups more difficult, as more variation is identified within groups when nasal and maxillary landmarks are included. These results support the hypothesis that the cranial vault may provide better resolution for population affinity as well as provide support for population continuity in the context of prehistoric southern Japan. These preliminary findings will be used to further elucidate how admixture between ancestral populations can impact cranial dimensions in forensically relevant samples, such as Hispanic populations, that are often encountered in the United States.

References:

1. Jantz RL, Ousley SD. FORDISC® 3.1: Computerized forensic discriminant functions. University of Tennessee. Knoxville, TN: 2010.

 ** Presenting Author*

2. Brace CL, Brace ML, Leonard WR. A multivariate craniofacial and odontometric perspective. Am J Phys Anth 1989;78:93-113.
3. Hanihara K. Dual structure model for the population history of the Japanese. Japan Review 1991;(2):1-33.
4. Holló G, Szathmáry L, Marcsik A, Barta Z. Linear measurements of the neurocranium are better indicators of population differences than those of the facial skeleton: Comparative study of 1,961 skulls. Hum Biol 2010;82(1):29-46.
5. von Cramon-Taubadel N. The relative efficacy of functional and developmental cranial modules for reconstructing global human population history. Am J Phys Anthropol 2011;146:83–93.
6. Kouchi M. Brachycephalization in Japan has ceased. Am J Phys Anthropol 2000;112:339-47.

Craniometric, Secular Change, Japan

 ** Presenting Author*