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An anthropometric assessment of craniofacial variation in historic and modern sub-Saharan African populations

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Abstract

Craniofacial morphology varies between populations and can be used to assess population history. As very little information is available regarding craniofacial morphology from living individuals, this study aimed to investigate craniofacial variation among historic western, eastern, southern-central and southern sub-Saharan Africa populations and a modern South African population, using anthropometric data of the head and face. From this, population variation between different sub-Saharan African groups as well as population history can be determined to gain a better understanding of the population movements throughout sub-Saharan Africa.

A historic data set of a total of 1346 individuals from various sub-Saharan communities, supplemented with 51 CT scans of the head and neck from a modern South African sample were used. The addition of CT scans allowed for a more complete dataset representing modern South Africans. The historic dataset contained anthropometric information and measurements which were recorded as hand-written documents. Twelve measurements (corresponding to the same measurements in the historic dataset) were taken from the CT scans using a three-dimensional (3D) DICOM viewer with an inbuilt measuring tool (OsiriXLite). Principal Components Analyses (PCA) were employed to assess craniofacial variation among individuals to determine which regions of the head and face are morphologically discriminative. Discriminant Function Analyses (DFA) were then employed to assess morphological differences and similarities between populations to assess the level of population separation possible. To determine whether geographic distance correlates to morphological distance, Mantel tests and Principal co-ordinate plots were used.

Overall, the Khoe and San population had smaller craniofacial morphology than Bantu-speakers while modern South Africans were the largest, particularly around the mandibular region. PCA revealed much overlap between the population groups. DFA revealed that eastern and southern Bantu-speakers shared a similar craniofacial morphology, whereas western and southern-central Bantu-speakers were more similar. The Khoe and San and modern South African populations were distinct in craniofacial morphology. There was no correlation between geographical and morphological distances, suggesting that geography and morphology are independent of one another. This is most likely because the Bantu-speaking populations had already inhabited regions where the Khoe and San lived.

The outcomes from the study suggest that anthropometric data can be used to assess population variation and population history. Sub-Saharan African populations are distinct in their craniofacial morphology and this may be due to environmental and functional responses due to population migrations. This study supports the current theories regarding both western and eastern stream Bantu-speaker migrations, with southern Africans probably branching from eastern African population groups.