A27 Estimating Ancestry in South Africa: A Comparison of Geometric Morphometrics and Traditional Craniometrics

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After attending this presentation, attendees will better understand: (1) the accuracy of two ancestry estimation software programs, FORDISC® 3.1. and 3D-ID, using discriminant function analysis in an international population; (2) which of these programs performed more accurately in the South African Black and White populations respectively; and, (3) suggestions for the improvement of these programs to make them more readily useful in contexts outside of the United States.

This presentation will impact the forensic science community by revealing accurate methods of estimating ancestry in South African individuals and distinguishing between Black and White individuals in the population. This presentation will encourage a broader scope in the utilization of ancestry estimation software programs created in the United States as forensic contexts abroad become more relevant.

In ancestry estimation of South African individuals, non-metric morphological trait assessment has not proven useful and previous results using FORDISC® leave room for improvement.[1,2] Results, when compared against the Forensic Databank (FDB) of FORDISC® 3.0 and a custom-made South African Database (SADB), both linger below the universally accepted accuracy of 75% for use in a forensic context.[2]

The accuracy rates of software programs FORDISC® 3.1 and 3D-ID were compared for ancestry estimation based on cranial data of Black and White South Africans using discriminant function analysis. Cranial landmarks were digitized using a MicroScribe® G2 for geometric morphometric analysis in 3D-ID, and traditional craniometric measurements for use in FORDISC® were calculated from these points using the data collection software 3Skull. Data was collected from a total of 385 individuals (186 Black and 199 White crania) from the Pretoria Bone Collection, University of Pretoria, South Africa. Overall accuracy rates of 75.6% using FORDISC® 3.1 and 63.1% using 3D-ID were obtained for Black and White South Africans. An assessment of intra-observer error was performed using intra-class correlation coefficients and all data showed high correlation between separate measurements of the same individual. Previous studies of inter-observer error in the use of a MicroScribe® to obtain cranial data showed agreement between Type I and Type II landmarks, with some dissent when collecting Type III landmarks.[3]

Higher accuracy rates were obtained when sex of the individual was already known or sex estimates made by the programs were disregarded. Incorrect estimates were more often due to misclassifications of sex rather than ancestry, reflecting the decreased amount of sexual dimorphism in South African populations when compared against American populations, discussed previously.[2] Black South Africans were more often classified correctly in FORDISC® 3.1, and White South Africans were more often classified correctly in 3D-ID, showing opposing biases in the two programs.

Low sample size in comparative databases and broad ancestral differences between South Africans and the proxy populations used, which included American, European, and African, likely explain the low accuracy rates. The accuracy rates obtained in FORDISC® 3.1 are slightly above 75%, making the program acceptable for use in a forensic context to estimate the ancestry of Black and White individuals in South Africa. 3D-ID has performed poorly in this population, though in some cases the program estimated ancestry correctly when FORDISC® 3.1 estimated the ancestry of the same individual incorrectly. Though FORSDISC® performed more accurately than 3D-ID, the use of both programs in conjunction can help South African anthropologists in estimating ancestry and ensuring correct classifications.

Reference(s):

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3. Ross A.H., Williams S. Testing repeatability and error of coordinate landmark data acquired from crania. *J Forensic Sci* 2008;53(4):782-785.

Ancestry, FORDISC®, 3D-ID