H14 Morphometric Comparison of Nasal Aperture Shapes Among Modern South Africans

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After attending this presentation, attendees will learn of the variation in mid-facial characteristics of African, European and Colored South Africans and to understand the statistical framework used to describe similarities and/or differences within and among these groups.

This presentation will impact the forensic science community by contributing to the knowledge base of human variation within a modern South African population, in providing a more scientific evaluation of this variation, and in presenting a mathematical approach to the classification of ancestral groups.

With more than 49 million people of various social identities, languages and belief systems, South Africa is an ideal country to evaluate human variation and the statistical relationship between social identity and biological characteristics. Because patterns of variation within and between populations are shaped by culture, language, geography, and secular change; it is necessary to define the effect these parameters may have on the reliability and accuracy of the commonly used methods for estimating ancestry as well as sex, stature and age-at-death. With a large database of population groups, FORDISC 3 has addressed problems regarding osteometric differences among populations. Mid-face and nasal bone morphology has been shown to be the most accurate region of the cranium to sort population groups in North American (Hefner) and South African samples (L'Abbé et al.).[1,2]

The purpose of this study was to assess variation in nasal bone structure, interorbital breadth and nasal shape, among African, European and Colored South Africans using elliptical Fourier analysis (EFA), geometric morphometrics (GM) and traditional linear measures through discriminant function analysis (DFA). Colored refers to a heterogeneous group of people in South Africa who are defined socially and geographically (Adhikari).[3]

A total of 310 crania of African, European, and Colored South Africans (165 males; 145 females) from the Pretoria Bone, Raymond A. Dart and Kirsten skeletal research collections in South Africa were used. All crania were photographed in the Frankfort plane, at a distance of 46 cm, using an Olympus 305 digital camera. Standard landmarks, which include subspinale, inferior point of nasal borders, alare, nasale inferius, dacryon, nasal superius, nasion and glabella, along with three nasal arcs were digitized using a MicroScribe G2. Inter- and intra-observer error was evaluated.

Geometric Morphometric (GM) analyzes including Procrustes fit (generating Procrustes Coordinates) and Elliptical Fourier analysis (EFA) were used to obtain shape variables. These variables as well as linear measures were imported into FORDISC 3.1 for linear discriminant function analysis (DFA). Statistical significance was assessed within and between ancestral groups. Each group was tested for normality and each was proven to be normally distributed. Outliers were identified through boxplots.

For all linear measurements, statistically significant differences between the sexes were observed in each ancestral group. But, these size differences did not affect classification of these groups. Mahalanobis distance was used to test the statistical significance between each ancestral mean for all variables. DFA with linear measures demonstrated a statistical significance among all groups, except for blacks and Coloreds which were metrically indistinct (p-*value*=0.062). However when size was removed, nasal aperture shapes were statistically different between these two groups. For osteometric and shape analyzes of the nasal aperture, European and African South Africans as well as European and Colored South Africans were significantly different (p-*value* < 0.01). Inter- and intra-observer agreement was high (0.7 and 0.8, respectively).

The differences observed between these groups may be used as a tool for estimating ancestry, especially with separating European and other South African groups. Colored groups were more likely to misclassify as Africans than Europeans, which may reflect the heterogeneous nature of the group and the history of the country. In evaluating and defining the nasal aperture, shape does provide more ancestral information than size.

To approach the evaluation of ancestry from unknown skeletal remains, the relationship between social and biological race has to be examined, understood and continually evaluated on modern groups. Large databases are needed and an understanding of the cultural history of the population is crucial for the interpretation of these differences.

References:

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2. L'Abbe EN, van Rooyen C, Nawrocki SP, Becker PJ. An evaluation of non-metric cranial traits used to estimate ancestry in a South African sample. Forensic Sci Int 2011:209(1-3):195.e1-7.
3. Adhikari M. Not white enough, not black enough: racial identity in the South African coloured community. Athens, OH: Center for International Studies, Ohio University Press, 2005.

Ancestry Estimation, Geometric Morphometrics, Discriminant Function Analysis

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