



Physical Anthropology Section - 2013

H53 Application of Cranial Indices to Estimate Ancestry in Modern and Historic South Africans

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After attending this presentation, attendees will gain knowledge of the applicability and accuracy of using cranial indices to estimate ancestry in modern Black and White South Africans and the historic Khoisan.

This presentation will impact the forensic science community by contributing to the knowledge of human variation in South Africa through testing the validity of current methodology. The results are to be used to establish best practices for estimating ancestry among modern South Africans.

In a diverse country like South Africa, the estimation of ancestry is an essential component for both the biological profile and the identification process. De Villiers and Steyn employed five cranial indices to quantify morphological differences among Black and White South Africans and indigenous Khoisan groups.^{1,2} Despite the absence of validity testing and the advent of robust statistical analyses, the mean values for these cranial indices continue to be used to separate these groups and to classify skeletal remains as either modern or archaeological.

The purpose of this study was to establish the accuracy of five standard cranial indices, namely the Cranial Index (CI), Upper facial Index (UI), Orbital Index (OI), Nasal Index (NI), and Gnathic Index (GI), in differentiating Black/White South Africans and Khoisan groups.

A total of 207 crania (110 females, 97 males) of Black South Africans, White South Africans, and Khoisan were used. White and Black groups were obtained from the Pretoria Bone Collection in South Africa, while skeletal remains of known Khoisan origin were obtained from the Rudolph Pösch Collection in Austria. Ten standard measurements were taken using a spreading caliper and a digital sliding caliper. Five indices were calculated and compared to specific sectioning points that had been assigned to the above-mentioned groups in *Fisiese Antropologie*.² Statistical analyses included an ANOVA and Tukey's method to test mean comparisons and statistical significance and percent correct to test accuracy of the indices.

For all five indices, two or more of the three groups had similar mean values. All indices had similar means for Black and Khoisan groups and no statistically significant differences were noted between them. With UI, no statistically significant differences were found among the groups. White and non-White groups demonstrated statistically significant differences for CI, GI, and NI. With OI, Khoisan groups demonstrated statistically significant differences from Black and White groups, but the latter two groups demonstrated no statistically significant differences between each other for this index.

For the groups that demonstrated statistical significance, new sectioning points were both created manually and using the Fisher-Jenks test. When the new and original sectioning points were compared, accuracy rates were generally higher for the new sectioning points (CI=73.55%; OI=71.57%; NI=88.18%; GI=79.88%) than the original sectioning points (CI=34.9%; OI=78.85%; NI=90.63%; GI=48.09%). Due to similar means, the sectioning points are usually only distinguishing White from non-White groups.

With the current sectioning points and group separation, cranial indices are not useful for describing differences among these social labeled groups. While Khoisan is a strong historical term, the crania of this group are generally not morphologically distinct from Black South Africans. Thus, the social designation is neither useful to understand ancestry in the population nor to sort modern and archaeological remains. Similar to other studies, White South Africans are clearly distinct from their non-White counterparts.^{3,4} Possible reasons include later emigration of White groups into South Africa (1652); past segregation laws; and social/cultural behavior.⁴ While the average accuracy of cranial indices is not as high as other more statistical robust methods, a revision of cranial indices and of their correction points has made this a valid and more appropriate method for use in South Africa.

References:

1. De Villiers H. The skull of the South African Negro: a biometrical and morphological study. Johannesburg: Witwatersrand University Press, 1968.
2. Steyn M. *Fisiese antropologie*. Pretoria: Department of Anatomy, University of Pretoria, 1993.
3. L'Abbé 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;209:195e1-195e7.
4. McDowell JL, L'Abbé EN, Kenyhercz MW. Nasal aperture shape evaluation between black and white South Africans. *Forensic Sci Int* 2102;222(1-3):397.e1-6.

Human Variation, Sectioning Points, Best Practice