

A60 The Frequency of Asymmetry in Non-Metric Craniofacial Trait Expression and Its Effect on Ancestry Assessment

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After attending this presentation, attendees will better understand the range of asymmetry within a forensic population.

This presentation will impact the forensic science community by emphasizing the importance of considering asymmetry when assessing ancestry and determining if the current method is the proper way to deal with asymmetry of traits.

The purpose of this study is to better understand the frequency of asymmetry in the craniofacial traits used to assess ancestry and to determine the effect of asymmetry, if any, on the results of the assessment.

Ancestry assessment is important in the creation of a biological profile of an unknown decedent. Non-metric trait frequencies have been compiled over time within forensic anthropology and are commonly used to analyze ancestry trait expression.¹ One of the most popular studies conducted on trait frequencies between and within groups was published by Hefner.^{2,3} It has been established that many craniofacial traits are asymmetric.^{4,5} Although Hefner briefly addresses asymmetry, noting that some traits (i.e., Inferior Nasal Aperture (INA)) exhibit it, and suggests scoring the left side in these cases; he does not go into the effects it may have on ancestry.⁷

Identified individuals curated at the C.A. Pound Human Identification Laboratory were assessed for the 11 non-metric traits described in Hefner. Of the 40 individuals, 15 were female and 25 were male. Ten of the 40 were of primarily African ancestry, 29 of primarily European ancestry, and one of primarily Asian ancestry. Six of the 11 traits (Anterior Nasal Spine (ANS), INA, Malar Tubercle (MT), Nasal Overgrowth (NO), Transverse Palatine Suture (TPS) and Zygomaticomaxillary Suture (ZS)) have the possibility of asymmetry due to being bilateral. The right and the left of each of these six bilateral traits were scored independently. A final ancestry assessment was made for both the left and right sides of each individual independently and, based on a simple majority of ancestry group trait expressions, each expression was assigned to the group with the highest frequency of that trait expression; for the purpose of this research, MT was not used in the final ancestry assessment due to incorrect frequency data in the Hefner 2009 article.⁶ The right- and the left-sided final ancestry for each individual was compared.

The results indicate that more than half of the individuals (22) had at least one asymmetric trait for a total of 26 asymmetric traits. Four individuals had two asymmetric traits; none had more than two. Thirteen of the 26 asymmetries (50.0%) were found in the ZSs, four in the INs, (15.4%), three in the NOs (11.5%), three in the MTs (11.5%), two in the ANS (7.7%), and one case was found in the TPS (3.9%). Of the 22 individuals with asymmetry, only three (14%) were classified into different ancestry groups for the right versus the left. In each of those three cases, one side resulted in Asian ancestry classification and the other side as European classification. With two of the cases, the left side was the correct ancestry, and in the third, it was the right side. All three of these individuals self-identified as White. Using a z-test, no significant difference ($p=115$) in the frequency of asymmetry between the ancestry groups was found. Males and females exhibited asymmetry with approximately similar numbers (53% in females and 56% in males).

A tentative conclusion can be made that asymmetry occurs most often in the ZS and least often in the TPS. Earlier studies concluded that the ANS had only small deviations.⁷ In this study, only two individuals had ANS deviations large enough to warrant a different trait expression in the right than in the left. This study suggests asymmetry can affect non-metric ancestry assessment, although this is uncommon. This finding is in line with other studies, which have noted that trait asymmetry is minimal.⁴ Using the left side when analyzing bilateral traits worked two-thirds of the time and there does not appear to be a reason to discontinue using this methodology. Note that the sample size is small and that the ancestry assessment was simplified from what it would be in an actual forensic case. Further testing will be needed to fully understand the degree of asymmetry in craniofacial traits and their effect on ancestry.

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Asymmetry, Craniofacial Traits, Ancestry