

### A74 Observer Error and Its Impact on Ancestry Estimation Using Dental Morphology

*Donovan M. Adams, MS\*, University of Nevada, Reno, 1664 N Virginia Street, Reno, NV 89557; Marin A. Pilloud, PhD, University of Nevada, Reno, 1664 N Virginia, Reno, NV 89557-0096; Heather J.H. Edgar, PhD, Maxwell Museum of Anthropology, MSC01 1050, 1 University of New Mexico, Albuquerque, NM 87131; and Joseph T. Hefner, PhD, Michigan State University, Dept of Anthropology, 355 Baker Hall, East Lansing, MI 48824*

After attending this presentation, attendees will understand how observer error impacts data collection on dental morphology and methods that use dental morphological data to estimate ancestry.

This presentation will impact the forensic science community by evaluating the utility of dental morphology in the estimation of ancestry as well as providing a comprehensive study on inter- and intra-observer rates for dental morphological data.

Traditionally, only a small set of dental morphological variants have been used as part of the “trait list” in the biological profile to estimate ancestry. As dental morphology has gained greater visibility within forensic anthropology, several methods have been developed to estimate ancestry that employ a range of traits; however, many forensic anthropologists have received limited training on the 36 dental traits that make up the Arizona State University Dental Anthropology system.<sup>1-4</sup> This study serves to explore how error can affect estimations of ancestry.

Data were collected on the same set of nine dental casts by ten different participants. The dental casts form part of the Economides Orthodontic collection housed at the University of New Mexico. Of these nine casts, three had an identified ancestry as European-American, three were Hispanic, and three were African American. Dental morphological data collected for each cast included 19 traits on multiple teeth. Volunteers were provided with extensive trait descriptions, dental cast exemplars, and scoring sheets. Participants supplied data on level of training in dental morphology, total time taken, as well as their highest degree and area of study. Data were collected on the same set of casts twice. Data from each observer for each cast were then evaluated for ancestry using the method proposed by Edgar.<sup>2</sup>

Intra-observer error on 636 data points using raw scores (not dichotomized) provided a Kappa statistic of 0.452, indicating moderate rater agreement. Inter-observer error varies by trait and observer experience. When data were input into the method of Edgar, results varied widely.<sup>2</sup> Correct ancestry assignment per individual ranged from two to seven (out of nine total), with an average of 3.5 correct. Total time spent on data collection ranged from 0.5 to 8 hours, with an average of 2.9 hours. There was a strong bias toward an ancestry assignment of Hispanic (74% of the results, 60/81). Two participants classified every single individual as Hispanic, and two more classified all but one individual as Hispanic. These researchers indicated moderate experience with dental morphology and took the least amount of time to collect the data (average 1.95 hours). Individuals who indicated low or high experience with dental morphology took more time to collect data (average 3.85 hours) and had higher rates of correct ancestry assignment (average 4.75 correct).

It is likely that the bias toward an estimate of Hispanic ancestry is related to improper recordation of the dental variation in these sets of casts. The Edgar method classifies individuals as Hispanic if any shoveling is present at a grade of one or higher, and/or the metacone/hypocone have a score of five.<sup>2</sup> Care must be taken to ensure that these traits are in fact present at these scores. Additionally, methods that employ breakpoints at the high and low ends of the variant scores appear to be more susceptible to observer error.

The results of this study indicate that ancestry estimation methods based on dental morphology have utility in forensic anthropology; however, they are only effective when the practitioner has proper training and care is taken in scoring traits.

### Reference(s):

1. Edgar H.J.H. Prediction of race using characteristics of dental morphology. *J Forensic Sci.* 2005 Mar;50(2):269-73.
2. Edgar H.J.H. Estimation of ancestry using dental morphological characteristics. *J Forensic Sci.* 2013; 58(s1):S3-S8.
3. Irish J.D. Dental nonmetric variation around the world: Using key traits in populations to estimate ancestry in individuals. In: Berg G.E., Ta'ala S.C., editors. *Biological affinity in forensic identification of human skeletal remains*. Boca Raton, FL: CRC Press; 2015;165-90.
4. Turner C.G., Nichol C.R., Scott G.R. Scoring procedures for key morphological traits of the permanent dentition: The arizona state university dental anthropology system. In: Kelley M.A., Larsen C.S., editors. *Advances in dental anthropology*. New York: Wiley-Liss; 1991;13-31.

---

### Observer Error, Dental Morphology, Ancestry Estimation