A61 Non-Metric Traits of the Mandible in Ancestry Estimation

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After attending this presentation, attendees will be more knowledgeable on the subject of ancestry estimation via non-metric traits of the mandible, briefly reviewing similar research, a discussion of metric versus non-metric methods of assessment, and examining why the mandible holds potential as an ancestry-discriminating bone.

This presentation will impact the forensic science community by examining and discussing the usefulness of eight non-metric traits of the mandible in ancestry estimation and by suggesting traits to be considered in future research.

Ancestry represents a fundamental aspect of the biological profile. Therefore, when seeking to identify unknown human remains, ancestry plays a crucial role in minimizing the number of potential missing persons matches.[1,2] However, ancestry is routinely cited as the most difficult aspect of the biological profile.[2-6] As this assessment relies heavily upon the use of non-metric skeletal traits that are often clinal in nature, categorizing and standardizing these traits remains a challenge for forensic anthropologists.[4]

The traits most useful in ancestry estimation are housed within the mid-facial cranium.[1-3,7-9] This small and particularly fragile region of the skeleton has received substantial attention and research efforts with regard to ancestry estimation.[9] The mandible and post-cranial elements are less often used in ancestry estimation and, accordingly, the literature on these regions is less robust. As the mandible is more durable than many bones of the mid-face, it is more likely that this bone will be recovered in medicolegal investigations and can be assessed for ancestry.[9] The mandible also offers a plethora of traits, which can be helpful when the bone is found fragmented or incomplete. Furthermore, the mandible creates a functional unit with the mid-facial cranium, the most reliable region for ancestry estimation. As such, the mandible may also house traits fruitful in this assessment.

This study investigates the expression of eight non-metric traits of the mandible, including: pinching of ascending ramus, chin shape, chin profile, undulation of inferior border, shape of sigmoid notch, gonial eversion, height of coronoid process, and rocker jaw. These traits were scored among a sample of 470 3D surface scans, which originated from individuals of African, European, and Native American ancestries. Two-tailed *t*-tests were used to assess the significance of scores among pooled sexes, pooled ancestries, collections (within each ancestral group), and sex within each ancestry. A subset of these *t*-tests was supplemented with chi-square tests of independence to further assess the significance of these traits.

The results of these analyses suggest that pinching of ascending ramus, chin shape, chin profile, and undulation are useful ancestry discriminating traits (chi-square p-values: 0.045, <0.001, <0.001, <0.001, respectively). In this study, Europeans stood apart in regard to chin shape and chin profile, with a square/bilobate chin shape and protruding chin profile occurring most frequently among this population (53.9% and 54.6%, respectively). Similarly, Native Americans exhibited fewest occurrences of undulation (combined slightly undulated and undulated frequencies at 41%), supporting existing notions of Native Americans displaying very robust mandibles, and Africans far out-numbered Europeans and Native Americans in incidences of round chin shapes (68.9%) and displayed the greatest number of receding chin profiles (24.3%).

As pinching of ascending ramus, chin shape, chin profile, and undulation revealed significant results in *t*-tests and chi-square tests in this study, these variables should be investigated in future research. This study serves to indicate that morphological differences do exist between African, European, and Native American ancestral groups and encourages additional future research on non-metric traits of the mandible.

Reference(s):

1. Parr, Nicole M.L. *Determination of Ancestry from Discrete Traits of the Mandible.* PhD diss., University of Indianapolis, 2005.
2. Bass, William M. *Human osteology: A laboratory and field manual of the human skeleton.* Columbia, MO: Missouri Archaeological Society, 2005.
3. Brues, Alice M. Forensic diagnosis of race — General race vs specific populations. *Social Science & Medicine.* 34, no. 2 (1992): 125-28. doi:10.1016/0277-9536(92)90089-9.
4. Burns, Karen Ramey. *Forensic Anthropology Training Manual*. 2nd ed. S.l.: Routledge, 2007.
5. Gill, George W. Chapter 14: Craniofacial Criteria in the Skeletal Attribution of Race. In: *Forensic Osteology*. 293-315. Springfield, IL: Charles C. Thomas, 1998.
6. Hinkes, Madeleine J. Realities of Racial Determination in a Forensic Setting. *Race, Ethnicity, and Applied Bioanthropology.* 1993, 48-53. doi: 10.1002/9781444306897.ch5.
7. Rhine, Stanley. Skeletal Criteria for Racial Attribution. *Race, Ethnicity, and Applied Bioanthropology.* 1993, 54-67. doi: 10.1002/ 9781444306897.ch6.
8. Warren, Michael W., Nicolette M. Parr, Carlos J. Zambrano, and Katherine E. Skorpinski. *Bare bones: A survey of forensic anthropology*. 2nd ed. Dubuque: Kendall Hunt Pub Co., 2008.
9. White, Tim D., and Pieter A. Folkens. *The Human Bone Manual.* Amsterdam: Elsevier Academic Press, 2005.

Ancestry Estimation, Non-Metric Traits, Mandible

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