A20 The Use of the Mandibular Symphysis for Estimating Ancestry

Ginesse A. Listi, PhD, LSU Geography & Anthropology, 227 Howe-Russell Bldg, Baton Rouge, LA 70803*

After attending this presentation, attendees will understand whether or not metric variation in the mandibular symphysis can be used to estimate ancestry in unidentified skeletal remains.

This presentation will impact the forensic science community by exploring a new metric method in the mandible for estimating ancestry from unidentified skeletal remains.

Maxillary prognathism is one of a suite of traits in the cranium that can be useful for differentiating between Sub-Saharan African and European ancestries in unidentified skeletal remains ("Black" and "White" individuals, respectively). While various metric and morphoscopic traits in the mandible also have been assessed for ancestry estimation, the projection of the mandibular symphysis that corresponds to maxillary prognathism has not been evaluated. Morphologically, this projection would include the area encompassing the anterior alveolar border, the incisive fossa, and the mental protuberance. This study assesses this projection for its potential in ancestry estimation using dimensions of the mandibular symphysis as a proxy.

Data were collected from 597 mandibles from the Terry Collection; 167 were measured twice to test for intraobserver error. Sliding calipers were used to take three measurements of the mandibular symphysis in the sagittal plane. Measurement endpoints included: infradentale prime, defined as the midpoint of a line tangential to the anterior-most projection of the alveolar processes of the central incisors; deep fossa, the posterior-most indention of the incisive fossa; and pogonion. Measurements consisted of: X, the distance from infradentale prime to deep fossa; Y, from infradentale prime to pogonion; and Z, from deep fossa to pogonion. Because endpoints are Type II landmarks prone to subjectivity, each measurement was taken three times per mandible, and the average was recorded.

A random sample of 75 individuals from each demographic group (Black and White, males and females) was selected for statistical analysis (N=300). Intraobserver error for each measurement was assessed on a random sample (n=63) using a paired t-test. None of the measurements exhibited significant differences (a=.05); therefore, all measurements were used in subsequent calculations and statistical analyses.

In addition to measurements, two indices and the incisive fossa angle were calculated to further explore symphyseal morphological variation. The indices included the "Symphyseal Index," derived by the formula $I_{symphysis}$=x/z, and the "Z index," derived by I_z=z/y. The incisive fossa angle was calculated using the inverse cosine function: A_{sulcus}=arccos $[(x^2+z^2-y^2)/2xz]$. Statistical analyses (Students' t-tests, linear regression) were used to assess variation in the measurements, indices, and incisive fossa angle between the sexes and ancestry groups. For all tests, significance was determined if $p < 05$.

Results of the t-tests reveal significant differences between the sexes for two out of three measurements (Y: t=5.674, p=.000; Z: t=6.219, p=.000); therefore, subsequent statistical analyses were conducted with the sexes separated. For males, significant differences were found between Black and White individuals in four of six variables: X (t=-8.153, p=.000), Y (t=-4.626, p=.000), $I_{symphysis}$ (t=-6.793, p=.000), and I_z (t=7.665, p=.000). For females, all variables revealed significant ancestry differences: X (t=-6.843, p=.000), Y (t=-6.424, p=.000), Z (t=-2.389, p=.018), $I_{symphysis}$ (t=-4.958, p=.000), I_z (t=5.635, p=.000), and A_{sulcus} (t=2.416, p=.017).

Regression analyses show similar results. For males, the same four variables are significant (X, Y, $I_{symphysis}$, and I_z): adjusted R-squares are .305, .120, .233, and .279, respectively. For females, all variables are significant: adjusted R-squares are .235, .213, .031, .137, .171, .033 for X, Y, X, $I_{symphysis}$, I_z, and A_{sulcus}, respectively.

This study demonstrates that a relationship exists between the dimensions of the mandibular symphysis and both sex and ancestry. Sex differences are not unexpected. A larger mental protuberance impacts pogonion, thus affecting all variables except X, and possibly accounting for the stronger predictive values of these variables in males. For ancestry, the superior portion of the symphysis (X) shows the strongest relationship in both males and females, followed by I_z, which represents the proportion of the lower symphysis to the entire symphyseal length; however, despite the association to ancestry, results indicate that simple linear measurements do not adequately capture symphyseal variation to the extent needed for prediction. Future analyses that use geometric morphometrics to quantify symphyseal curvature may yield better predictive results that can be used in forensic contexts.

Ancestry Estimation, Mandible, Forensic Anthropology

*Presenting Author