A11 The Use of the Mastoid Triangle for Sex Estimation

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After attending this presentation, attendees will better understand the use of the mastoid triangle for sex estimation in adult individuals.

This presentation will impact the forensic science community by providing insight into a method for sex estimation using metrics of the mastoid triangle. In addition, this presentation demonstrates the need for additional research into the use of the mastoid triangle for sex estimation.

Sex estimation is a key parameter of the biological profile because it allows for sex-specific methods to be employed in the estimation of other aspects of the biological profile. Previous studies utilizing the mastoid process for sex estimation have focused on both metric and non-metric traits of the mastoid process itself; however, Paiva and Segre measured the area of the mastoid triangle, defined as the area between asterion, mastoidale, and porion, and found significant sex differences.[1] Subsequent studies have found significant differences between males and females using dimensions of the mastoid triangle; however, no studies have examined the use of shape differences of the mastoid triangle for sex estimation. The goal of the present research is to metrically examine size and shape differences of the mastoid triangle between males and females.

A total of 200 adult individuals of known sex were sampled from the Hamann-Todd Collection housed at the Cleveland Museum of Natural History: 100 males and 100 females. Using a digitizer, three coordinates were collected from the left side of the cranium: Asterion (AST), Mastoidale (MS), and Porion (PO). Three Interlandmark Distances (ILDs) were calculated to explore size differences, and Geometric Morphometric Analyses (GMA) were conducted to explore shape differences. Classification accuracy was assessed using jackknifed Linear Discriminant Function Analysis (LDFA) of the ILDs, Procrustes Coordinates (PCoords) generated from the GMA, and Principal Components (PCs) generated from the principal component analysis.

Using LDFA of all three ILDs, correct classification between the sexes was 72.5% (females 73%, males 72%). Using separate ILDs, classification accuracy between the sexes was highest using LDFA of MS-PO (overall 71.35%; females 73.7%, males 69%), followed by AST-MS (overall 67.5%; 66% females, 69% males), and AST-PO (overall 63.3%; females 59.6%, males 67%). In addition, males were significantly larger ($p < 0.05$) than females for all three ILDs. Classification accuracy between the sexes using LDFA of the PCoords was 70.5% (females 67%, males 74%), which is similar to and slightly less than the size analysis. The first two PCs accounted for 99.9% of the variance, and classification accuracy between males and females using LDFA and these two PCs was 65.5% (females 68%, males 63%).

The results of this study demonstrate statistically significant differences between the mastoid triangle of males and females. Classification accuracy was highest using the ILDs; however, the results using the PCoords were comparable. The results of this study are similar to previous studies, which found significant differences between the mastoid triangle of males and females; however, classification accuracy using AST-PO differs from Jain et al.'s reported 45% classification accuracy.[2] This may be due to variability in the location of asterion between individuals and populations.[3] Combining the size and shape analyses from this preliminary study with the measurement of mastoid area or including measurements of both the left and right mastoid triangles in the analyses have the potential to produce even higher classification accuracies.

Reference(s):

1. Paiva, Luiz Airton Saavedra De, and Marco Segre. Sexing the human skull through the mastoid process. *Revista do Hospital das Clínicas.* 58 (2003): 15-20.
2. Jain, Deepali, O.P. Jasuja, and Surinder Nath. Sex determination of the human crania using mastoid triangle and opisthion-bimastoid triangle. *Journal of Forensic and Legal Medicine.* 20 (2013): 255-259.
3. Petaros, Anja, Sabrina Sholts, Mario Slaus, Alan Bosnar, and Sebastian Wärmländer. Evaluating sexual dimorphism in the human mastoid process: A viewpoint of the methodology. *Clinical Anatomy.* 28 (2015): 593-601.

Sex Estimation, Mastoid Triangle, Geometric Morphometrics