A51 Sexual Dimorphism of the Zygomatic Bone in a Southeast Asian Sample

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The goal of this presentation is to inform attendees of the potential use of the zygomatic bone in assessing sex during the construction of a biological profile.

This presentation will impact the forensic science community by providing the foundation for developing a discriminant function equation using three linear measurements from the zygomatic bone to estimate the sex of fragmentary human remains.

The attribution of sex is an important component of the biological profile, but is often complicated by the lack of the most diagnostic elements typically used for sex estimation in fragmentary human remains. Prior research has suggested the zygomatic bone, a bone that is often recovered in the archaeological context, is sexually dimorphic. The Workshop of European Anthropologists noted an increased robusticity of the marginal process in European males, where Woo noted a maximum height and width difference between males and females in an English anatomical collection, and Wilson noted a size and shape difference between modern American White males and females from the William M. Bass Collection.[1-3] Specifically, Wilson demonstrated, through the use of geometric morphometrics, that the shape of the zygomatic bone can discriminate between American males and females at an 86% classification rate; however, digitizing a single element is not always practical or available to forensic practitioners, necessitating methods that use traditional caliper-based measurements.[3] Further, prior research only evaluated samples from European populations. Thus, this research utilized a Southeast Asian sample to determine the discriminatory power of three linear measurements of the zygomatic bone for sex estimation.

The maximum height and width of the zygomatic bone, defined previously, and the maximum width of the frontal process, defined for this study, were collected from the left and right zygomatic bones of 202 modern Southeast Asian individuals (102 females aged 26-84 years and 100 males aged 22 to 96 years) housed at Khon Kaen University (KKU), Khon Kaen, Thailand, using sliding calipers.[2] Measurements were obtained from individuals for whom complete, unfractured zygomatic bones were available. Independent t-tests determined that no significant difference (p-value>0.05) existed between the left and right sides for all three measurements; therefore, all subsequent analyses used pooled samples. All analyses, including a linear discriminant function analysis, were conducted using a statistical computing software.

The mean maximum height of the zygomatic bone is 48.2mm (95% SD=3.4mm) in males and 45.4mm (95% SD=3.3mm) in females, the mean maximum width of the zygomatic bone is 54.7mm (95% SD=3.7mm) in males and 50.8mm (95% SD=3.8mm) in females, and the mean maximum width of the frontal process of the zygomatic bone is 14.7mm (95% SD=2.2mm) in males and 12.6mm (95% SD=1.8mm) in females. A linear discriminant function analysis demonstrated that all three measurements are important in discriminating between Thai males and females, with the maximum width of the frontal process contributing more than the other two measurements. Further, the combination of these three measurements correctly classified 75% of the sample (74.5% of males and 75% of females).

When compared to previous research, the maximum height and width of the Thai zygomatic bone is larger than the modern American zygomatic bone for both males and females. This is not unexpected, as several researchers have noted population differences in the zygomatic bone, with individuals of Asian ancestry having larger malar regions. Future validation testing will need to test the universality of any discriminant function equations from the linear measurements due to this size difference. Additionally, the size differences between males and females in the Thai sample are less than those in the American sample, which supports the belief that Southeast Asians are less sexually dimorphic than Americans. Nevertheless, differences in the linear measurements from both samples are significant and can discriminant between males and females, which lends credence to the utility of the zygomatic bone as a criterion for assessing sex in fragmentary remains.

References:

1. Workshop of European Anthropologists. Recommendations for age and sex diagnoses of skeletons. *J Hum Evol* 1980;9:517-549.
2. Woo TL. A biometric study of the human malar bone. *Biometrika* 1937;29:113-125.
3. Wilson RJ. Sexing the zygomatic bone. *Proceedings* of the American Academy of Forensic Sciences; 57th Annual Scientific Meeting. New Orleans LA 2005.

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