



Physical Anthropology Section – 2011

H31 Sex Discrimination Using Patellar Measurements: Method and Validation Study

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After attending this presentation, attendees will understand how to determine the sex of Americans using discriminant functions derived from common patellar measurements.

This presentation will impact the forensic science community by introducing a series of easily applicable discriminant functions for use in determining the sex of Americans using a single patella. Subsequent validation of the method, using an independent American sample, indicates the method is robust. The visual inspection of associated ROC curves provides a means of selecting among the available discriminant functions. Based on the results of this analysis, the patella is offered as an alternative method to determine sex when others are not applicable.

Although a number of previous projects have presented discriminant functions for sexing the patella, these methods are derived from African and European populations. To date, no specific patella based sex classification method in the scientific literature is available, which is both easily applicable and calibrated for use with Americans. This project addresses this issue using a sample of 182 individuals combining white and black males (100) and females (82) from the Hamann-Todd collection. Each individual possessed data on the left and right patella height, width, and thickness. The left and right values were later averaged for each measurement to make the applicable to a single bone of either side. Males possessed an average patellar height of 44.12 mm \pm 2.93mm, an average patellar width of 44.57 mm \pm 3.17 mm, and an average patellar thickness of 21.03 mm \pm 1.57 mm. Females possessed an average patellar height of 38.83 mm \pm 2.94 mm, an average patellar width of 39.10 mm \pm 2.95 mm, and an average patellar thickness of 19.01 mm \pm 1.57 mm.

The three measurements used in seven different combinations were examined using discriminant function analysis. The resulting discriminant functions generated average classification rates between 73.5% and 83.5% when cross-validated with average classification rates ranging between 73% and 83% for males and 74.4% and 85.4% for females. These results are similar to previous studies and generally indicate the method is robust, but a more powerful and convincing test of the method is by applying it to an independent sample. Here an independent American sample of patella measurement data from a series of 300 white and black males (147) and females (153) from the Terry collection, obtained by O'Connor (1996) was used to test the classificatory power of the Hamann-Todd patella discriminant functions. Upon testing, the efficiency drops an average of 3% to achieve values between 70% and 79%. The correction classification rate among males ranges between 68% and 80% and for females between 75% and 80%.

Reduced efficiency is a common result of validation but the overall classification rates remain relatively high. Among the seven discriminant functions, the most effective can be identified using the classification rate, but a visual method comparing ROC curves is used. The associated statistics indicate that all seven discriminant functions provide results that are significantly different from random guessing. The most consistent equations being those developed with patella width and height.

Although the present method does not yield correct classification rates of 90%, the best validated discriminant functions does a provide classification rate of 79%, which suggests the method has potential for sex discrimination. Since the patella is a small bone, with a dense structure, and is often recovered intact, the discriminant functions developed here are offered to the scientific community as an alternative method, applicable when other more powerful methods cannot be used due to recovery or preservation issues and as check on the results obtained using other methods.

Patella, Sex, Validation