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ESTABLISHING AGE ESTIMATION METHODS FROM THE AURICULAR SURFACE OF THE ILIUM FOR NON-HUMAN PRIMATES: ADAPTING BUCKBERRY AND CHAMBERLAIN SCORIING METHOD AND EXPLORING THE USE OF SHAPE CHARACTERIZERS FOR AGE PREDICTIONS

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Abstract

Age estimation is a vital component of the biological profile; used in forensic anthropology to establish positive identification in medicolegal cases. Age prediction methods have been created and well-researched for human populations. However, for non-human primate populations, standardized age estimation methods that focus on the postcranial skeleton are scarce. This project aimed to construct age estimation approaches in a model organism of rhesus macaques of known ages, using the auricular surface of the ilium.

The objectives of this project were: (1) to adapt the forensic macroscopic age estimation method revised by Buckberry & Chamberlain (2002), (2) to apply 3D surface texture quantification to blue light scans of ossa coxae, (3) to use developed methods to create age estimations, (4) and to test the accuracy and replicability of the models.

An adjusted cross-sectional sample of 87 adult rhesus macaques from the free-ranging Cayo Santiago population were observed and scanned. Definitions and scoring systems of five morphological variables were adjusted (transverse organization, surface texture, microporosity, macroporosity, and apical/outline changes), after which specimens were scored and composite scores were summed. Numerical outputs from two shape characterizers – dirichlet normal energy (DNE) and orientation patch count rotated (OPCR) – were generated.

Spearman's R results revealed a significant correlation between the five morphological variables, DNE, OPCR and age. Composite scores had the highest R^2 value of 0.82. There were no significant differences between males and females, or os coxae sides for both the macroscopic method and DNE, however, this was not true for OPCR. Ordinary least squares (OLS) results revealed significant values between macroscopic features, DNE, OPCR, and age. Multiple regressions revealed than DNE and composite scores were the most significant contributors to age. Macroscopic model IV which excluded macroporosity, and the DNE model V were selected for further testing. The composite score method was better at predicting life stages than the DNE model. The composite score model had the lowest overall inaccuracy and correctness scores, but the DNE model had the lowest overall bias score. Both the DNE model V and macroscopic model IV had substantial agreement between interobservers. For intraobserver rates however, the DNE model had lower intraobserver error than model IV.

Between the selected models IV (macroscopic method) and V (DNE surface quantification), model IV seemed to be the most accurate since it had the least SSE value at 85.5 and thus, the most recommended for use. The DNE model could also be used, but further testing is recommended. Using both composite scores and DNE methods would provide a more comprehensive age range. This project provides a foundation for age estimation methods for non-human primates, as well as for the extension of surface quantification analysis for use in human age estimation.