A18 Traditional Morphometrics of the Juvenile Skull: An Analysis of Ontogenetic Growth Patterns

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After attending this presentation, attendees will understand a novel method of juvenile age estimation involving linear measurements of the cranium.

This presentation will impact the forensic science community by providing a novel method of juvenile age estimation.

This study assesses patterns of ontogenetic growth and, by association, morphological variation in juvenile crania from a Western Australian population. Current methods of juvenile age estimation largely relate to quantifying dental development and skeletal growth; the latter occurs in a predictable and known pattern and is not as readily affected as other skeletal elements by nutritional and other environmental disruptions during growth and development. The current study develops age prediction models using linear measurements of the juvenile cranium and explores novel methods of age estimation based on ontogenetic growth. The specific goals are: (1) determine the most accurate single predictor polynomial model for age; (2) determine a model of age estimation that is derived from all linear terms of predictors; (3) determine a model that includes linear, quadratic, and cubic terms of all predictors; and, (4) create age prediction models based on linear measurements.

The study sample comprised 174 cranial Multi-Slice Computed Tomography (MSCT) scans of individuals ranging in age from birth to 18.76 years (98 males and 76 females). The MSCT scans were acquired from the Western Australia Department of Health Picture Archiving and Communication Systems (PACS) database. The MSCT scans are visualized using OsiriX® and 52 homologous landmarks are acquired in each cranial scan. MorphDB and morphologika are then used to calculate 27 linear measurements between landmarks.

Prior to all data collection and analyses, the level of accuracy and precision was quantified to ensure data are repeatable and reliable. Measurement error was quantified using Technical Error of Measurement (TEM), relative Technical Error of Measurement (rTEM), and coefficient of Reliability (R). The linear measurements are analyzed with Statistical Package for Social Science (SPSS) and Excel®. Asymmetry was evaluated through correlations between bilateral measurements; a paired sample *t*-test was performed to explore the statistical significance of any bilateral variation. The root mean squared error of prediction (the calculated difference between the actual and predicted age) was used to determine the most accurate age prediction model for each measurement. Multivariate models were also considered to determine whether using more predictor variables had beneficial effects on being able to predict the response.

Age prediction models were developed based on interlandmark distances. Individual and pooled sex models were produced, with prediction accuracy ranging from ±1.3 to ±2.7 years. The single most accurate predictor of age in the pooled sex sample was palatine height (±2.3 years). Age prediction models were formulated using single and multiple linear and polynomial regression analyses; accuracy rates were deemed acceptable relative to extant methods of juvenile age estimation. This study has developed novel methods of age estimation in juvenile crania and also provides a strong foundation for further research.

Juvenile Age Estimation, Craniometric Analysis, Virtual Anthropology