



Physical Anthropology Section – 2011

H33 Age Estimation Utilizing Postnatal Dental Mineralization: An Exploratory Analysis of Molar Development for a Contemporary Florida Population.

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After attending this presentation, attendees will understand that a more accurate construction of dental age estimation standards can be achieved by considering population age structure and by utilizing Bayesian analysis. The objectives of this study are to explore the patterns and timing of dental development for a contemporary Florida population, to test the accuracy of current dental age estimation standards for juveniles and young adults devised by Moorrees *et al.* (1963), and to evaluate the accuracy of age estimation utilizing third molar development.

This presentation will impact the forensic science community by presenting data related to estimating appropriate dental ages for unknown juveniles and young adults utilizing advanced stages of molar development. The accurate estimation of age utilizing molar development can have important legal implications for living individuals for which chronological age is unknown since the observation of advanced mineralization stages in third molars can provide insight into whether or not an individual is likely to have reached 18 years of age. This information can assist courts within the United States in determining whether or not an individual is legally considered a minor or an adult.

Due to the strong genetic component of dental development, research has shown that mineralization patterns of the human dentition are relatively buffered against environmental influences that normally affect bone growth and development (Cardoso 2007). It is because of this resistance to environmental factors and the continuous growth of the permanent dentition throughout childhood and adolescence that the evaluation of dental development patterns has become the preferred method of age estimation in living and deceased children.

While it has been suggested that the timing of dental development varies by ancestral descent and geographic populations, further exploration of the role of statistical modeling in the comparisons of dental development tempo and patterning among populations is necessary. For this study, 81 panoramic radiographs of individuals (33 males and 48 females) from a contemporary Florida population ranging in age from 7.7-20.4 years were reviewed. The mean age for males included in this study was 15.7 years, while the mean age for females was 16.1 years. Maxillary and mandibular third molars were observed and assigned a mineralization score ranging from 1-14 in accordance with dental development standards devised by Moorrees *et al.* (1963). Previous research (Demirjian 1978) suggests that dental development occurs symmetrically between tooth types in each dental arcade. Therefore, one score was obtained for each tooth type. Most scores were obtained from teeth in the left side of the mouth; however, in instances where the development stage of the left tooth was not clearly visible, the

development stage of the corresponding tooth on the right side of the mouth was scored. Similarly, most scores were obtained by observation of the mineralization stage of the distal root; however, in instances for which the mineralization stage of the distal root was not observable, the mesial root was scored. Of 246 molars observed, 53 were maxillary third molars, 77 were mandibular first molars, 77 were mandibular second molars, and 39 were mandibular third molars. Maxillary first and second molars were not scored due to the difficulty in observing advanced mineralization stages of maxillary teeth on panoramic radiographs.

Previous research has suggested that females achieve advanced dental development stages earlier than males (Tompkins 1996). Therefore, each sex was treated independently, and mean ages for attained development stages were calculated for each tooth. The mean age of complete root apex closure of the third maxillary molar (stage 14) for males was 19.5 years, while the mean age of complete root apex closure of the third mandibular molar (stage 14) for males was 17.6 years. Similarly, the mean age of complete root apex closure of the third maxillary molar (stage 14) for females was 18.5 years, while the mean age of complete root apex closure of the third mandibular molar (stage 14) for females was 18.8 years.

The accurate observation and comparison of stages of molar development can serve as a noninvasive method for evaluating the probability of whether or not an unknown individual is likely to have reached 18 years of age. The refinement of existing dental age estimation standards can be achieved by incorporating a Bayesian statistical analysis, transitional analysis, and a cumulative probit model on the log scale ages.

Dental Mineralization, Age Estimation, Bayesian Analysis