F22 Dental Age Estimation Combining Developmental and Morphological Age Predictors

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After attending this presentation, attendees will be informed on the age predicting effect combining age related dental variables based on third molar development and on tooth morphology.

This presentation will impact the forensic science community by providing knowledge that, observed on orthopantomograms, data combining developmental variables of third molars and morphological changes of other teeth is not improving age predictions based only on third molar development.

Most frequently asked questions from judicial authorities regarding age estimations in living individuals is whether or not the age of majority is reached. In most countries this age threshold is set at 18-years-old. For this sub-adult age category dental age estimations are most commonly based on developmental changes of the third molars. Compared to all other maturing teeth, third molars have the highest human variability, resulting in age estimations with wide prediction intervals. For the adult age category, dental age can be estimated examining divers morphological tooth variables. One of them, apposition of secondary dentine on the walls of the pulp cavity can be evaluated in living individuals using radiographs. This technique was developed on periapical radiographs by Kvaal et al. (1995). Divers authors studied the feasibility of the Kvaal technique on orthopantomograms. The goal of this study was to detect on panoramic radiographs if additional tooth morphological measurements according to the Kvaal technique ameliorate the accuracy of age estimations based on scores of third molar development.

Retrospectively, 450 digital orthopantomograms from individuals with a Belgian nationality and Caucasian origin were collected from the dental clinic files of the Katholieke Universiteit Leuven. In the age range between 15 and 23 years, 25 radiographs were selected in each age category of one year for both genders. All available third molars were classified and scored according to the ten stage system proposed by Gleiser et al. (1955) and modified by Köhler et al. (1994). The Kvaal technique was applied on the upper central and lateral incisor and second premolar, as well as on the lower lateral incisor, the canine, and the first premolar from the left side. On the obtained measurements, the mean of length and width ratios (M), and the difference of mean width- and mean length ratios (W-L) were calculated separately for each tooth, for all upper, for all lower, and for all six teeth. After one month, twenty randomly selected orthopantomograms were rescored and measured again by the same and another observer to detect a high intra- and inter-observer reliability. Linear regression models with age as response and third molar scores as explanatory variables were established for the whole sample and for males and females separately. To these models M and W-L measurements were added for each of the six measured teeth, for all upper, all lower and all six teeth together. From the models the determination coefficient (R^2) and the root mean squared error (RMSE) were calculated.

The regression models calculated on the whole sample and including only third molar scores information revealed a R^2 of 0.60 and RMSE of 1.63 years. Adding the Kvaal information (M, W-L) maximally increased R^2 with 1% and decreased RMSE with maximally 0.02 years (for FDI tooth #22). The regression analyses performed separately for males showed comparable results. In the regression analyses based on females less accurate predictions were detected, most supplementary Kvaal information was observed adding the measurements of all six teeth.

Adding radiologically observed morphological secondary dentine apposition information to developmental third molar information was not providing more accurate age predictions. Moreover, the Kvaal technique was time consuming and not applicable on all panoramic radiographs.

Forensic Odontology, Age Estimation, Third Molar Development and Kvaal Technique

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