F34 Effects of Combining Radiological Third Molar and Cervical Vertebrae Development on Human Age Estimation

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After attending this presentation, attendees will be informed on combining dental and skeletal age related variables for age predictions.

This presentation will impact the forensic science community by providing an improvement of age predictions combining third molar developmental data obtained from orthopantograms and cervical vertebrae data collected from encephalographs.

For the sub-adult age category, dental age estimation is most commonly based on third molar development. Third molar development has, compared to all other developing teeth, the highest human variability. This results in age predictions with wide prediction intervals. Therefore the accuracy of age predictions combining information of third molar development collected on orthopantograms with information of skeletal development collected on cephalographs is evaluated.

In a pilot study the skeletal variable and the method providing most information about age was searched on cephalographs. Cephalographs of 500 individuals from central India (238 F, 262 M) with known chronological age between 4 and 25 year were collected. All cephalographs were imported into a graphics editing software program and scored or measured following the techniques described by Baccetti (B), Hassel and Farman (HF), Caldas (C) and Rai (R). Regression models with age as response and each of the four scoring or measurement values as respective explanatory variable were established. To compare these models the proportion of the variability in age explained by the explanatory variable (R-square) and the magnitude of the age prediction error (Root Mean Squared Error, RMSE) were calculated.

In the main study orthopantograms and cephalographs, taken from the same individual on the same date were evaluated. Retrospectively 460 Belgium individuals (236F, 224M) with chronological age between 3 and 25 years were selected from the dental clinics of the Katholieke Universiteit Leuven. All radiographs were imported into a graphics editing software program. On the orthopantograms third molar development was scored following a modified Gleiser and Hunt (GH) technique. On the cephalographs cervical vertebrae development was scored following the B and the HF technique. Regression models with age as response and information from GH, GH, and B, and GH, B, and HF as explanatory variable(s) were fitted. The stages of the left and right

third molars were highly correlated. Therefore, in the GH models the stages of the left molars were used, reducing the multicollinearity issue. Because missingness of third molar values at lower age may contain information about age, missingness patterns were included in the GH models. R-square and RMSE were calculated for comparison of the age predictions of each of these three regression models.

In the pilot study, the variability in age was explained for 58%, 55%, 26%, and 3% for respectively the B, HF, C, and R scorings or measures. The detected RMSE were 3.19 (B), 3.28 (HF), 4.22 (C), and 4.83 year (R). Therefore in the main study B and HF were retained for further evaluation.

In the main study detected R-square and RMSE were respectively
0.38 and 3.59 year for the models using GH, 0.87 and 1.67 year for the models combining GH and B and 0.88 and 1.57 year for the models combining GH, B, and HF. The inclusion of information from the cephalographs based on the B technique drastically improved the age predictions in this sample, compared to predictions based on only GH scorings. Additional inclusion of scores based on the HF technique almost didn't further improve these predictions.

Forensic Odontology, Age Estimation, Third Molar and Cervical Vertebrae Development

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