

Mai Britt Bjørk, Sigrid I. Kvaal, Øyvind Bleka, Tomas Sakinis, Frode A. Tuvnes, Peter Mæhre Lauritzen, Mari-Ann Haugland, Heidi Beate Eggesbø (Oslo, Norway)

MRI segmentation of 3rd molar tooth tissue volumes to predict age older than 18 years in sub-adults

Purpose: Our aim was to investigate the relationship between age and 3rd molar tissue volumes measured by segmentation of MRI with the purpose to predict age older than 18 years in sub-adults.

Material and method: We recruited 99 healthy volunteers from 14 to 24 years of age. We used a 1.5T MR Scanner (Magnetom Avantofit, Siemens) with two bilateral surface coils and a customised short (5 min 4 sec) high resolution single T2-sequence acquisition with 0.37 mm iso-voxels. Two dental cotton rolls, size 2, drawn with 2 ml water stabilised the bite and delineated teeth from oral air.

Segmentation of the tooth tissues, dentine (including enamel and cementum), predentine and pulp, was performed on axial images based on T2- signal intensity thresholding using SliceOmatic (Tomovision[®]), and the volume of each tissue was measured.

Statistical analyses: We used linear regression to analyse the association between the explanatory variables (age and sex) and several possible response variables (different combinations and mathematical transformations of the tooth tissue volumes). Akaike Information Criterion was used to select the model type for sex and variance weighting. Performance of different ratios of tooth tissue volumes and tooth combinations were assessed based on the p-value of the age variable, common or separate for each sex depending on the selected model. A Bayesian approach was applied to obtain the predictive probability of being older than 18 years.

Results: After exclusion, we included 67 volunteers (F/M: 44/23), range 14-24 years, median age 18 years. The mean volumes of dentine, pulp and predentine for both sexes were: 0.75, 0.06 and 0.02 ml. The ratio (Pulp + Predentine) / Total volume for upper 3rd molars had the strongest correlation with age ($p=3.4 \cdot 10^{-9}$) and performed best for both sexes. For the selected model, four hypothetical observations were used to illustrate the probability of an individual being older than 18 years given the observed tooth tissue volumes (Bayesian approach).

Conclusion: The ratio (Pulp + Predentine) / Total volume for upper 3rd molars had a strong correlation with age. MRI segmentation of tooth tissue volumes might prove useful in the prediction of age older than 18 years in sub-adults.