F31 Age Estimation Based on a 3D Cone Beam Computed Tomography (CBCT) Study of the Pulp Cavity and Hard Tissues of the Teeth for Forensic Purposes

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After attending this presentation, attendees will learn a quick method which can be of help in odontological age estimation procedures in the living and which is of striking value for its accuracy, simplicity, and usefulness.

This presentation will impact the forensic science community by providing the professional community with a quick and easy odontological method that is useful in current, often-requested age estimation procedures in the living.

Background: Age estimation is a mainstay of the reconstructive identification pathway of the living individual as well as of the dead, and, among the others, the odontological methods are considered to be quite reliable. In adults, the dental age can be estimated by the analysis of the progressive physiological and degenerative phenomena which affect the teeth and, among them, the secondary dentinal apposition. Along with the histo-pathological methods of dental age estimation, the recent introduction of the devices for the three-dimensional processing of the radiographic images of the teeth, such as the modern CBCT, allows the adoption of a non-invasive/destructive, reliable, and rather accurate method for dental age estimation.

Goal: The goal of the present research is to develop a non-invasive, conservative, reliable, accurate, and simple method of dental age estimation in the living by mean of the analysis of the volume decrease phenomena which affect the pulp cavity of the teeth. The examined method provides a specific software which allows the measurement of the volume of hard and soft dental tissues on the basis of the 3D radiographic images from the CBCT.

Materials and Methods: Two operators randomly selected and analyzed 295 CBCT radiographs of Caucasian subjects made for ordinary clinical purposes (Scanora® 3D dental cone beam unit). The sample of the CBCTs consists of 116 male individuals and 179 females in the age cohorts between 10 and 79 years. The image of the upper left central incisor has been extrapolated from the radiographs in DICOM file format using OnDemand 3D software. To measure the volume of the dental tissues involved, the images have been then elaborated with an innovative method of geometric approximation of the dental anatomy: the ratio “pulp cavity volume/dental hard tissues volume” has been obtained and then correlated with the age of the subject. An inter-rater agreement has been performed. The results have been statistically analyzed and a special but easily usable formula has been elaborated.

Results: The research needs to be implemented with the results from a larger number of exams before drawing final conclusions. The preliminary results are encouraging since the CBCT and the adopted method allow a precise and accurate measurement of the volume changes of dental tissues caused by aging. The research shows a high correlation between dentinal apposition and the calculated ratio, and the age of the individuals with respect to gender and age cohort. Moreover, the study of the volume instead of the linear or area measurement of the dental structures seems to be a promising approach, being the volume less influenced by X-ray distortion. The easy calculation of the rate with the proposed method has taken no more than ten minutes each. Consequently, the method is quick and simple, and offers the best chance to reveal and to measure the correlation of such volume changes with the age of the subject, thus obtaining useful evidence to assess age of a living adult in forensic practice.

Conclusion: The presented method is a promising tool in the procedure for age estimation, permitted by the high technological level achieved by the currently available machines for the CBCT. Due to the correlation with age, the low-dose exposure to X-rays, the conservative and easy approach, time saved, and the economically irrelevant difference in costs between the CBCT and the Orthopantograph (OPG) exam, the adopted procedure can be considered technically reliable and affordable for forensic purposes.

Human İdentification, Dental Age Estimation, Cone Beam Computed Tomography

