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### G11 An Age Estimation Procedure Based on the 3D Cone Beam Computed Tomography (CBCT) Study of the Dental Pulp Volume in Adults

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

This presentation will impact the forensic science community by providing a quick and easy odontological method, useful in the current ever-more-requested age estimation procedures in the living.

**Background:** The dental age of adults can be estimated by analyzing progressive physiological and degenerative phenomena affecting dental tissues. The pulp-dentin complex is a dental structure that exhibits age-dependent modifications, which result primarily in reduction of pulp chamber volume due to the continual deposition of secondary dentin. This study extends a previous pilot study and evaluates the accuracy of CBCT analysis of pulp chamber volume to estimate the age of living individuals.

**Materials and Methods:** Two operators randomly analyzed 277 CBCT radiographs and considered the upper left central incisor. The sample contained radiographs of 110 males and 167 females between 10 years and 80 years of age. This research was designed to simplify the dental volume measurement through a geometric approximation of different parts of the tooth. The root and the pulp were approximated as elliptical cones, and the crown was approximated as an elliptical truncated cone. The volumes were computed using Osirix® software. The ratio between the pulp volume and the hard tissue volume (*PHr*) was assumed as a variable according to the following formula:  $PHr = V(P)/V(H)$ . This method was validated using three extracted teeth from different individuals and comparing the dental volumes calculated by CBCT with the real volumes physically measured *in vitro*.

**Results:** The physical measurements revealed that the CBCT analysis consistently underestimated the real dental pulp volumes by 53%-70%; however, the error occurred for estimation of both pulp and hard tissue volumes, and it tended to be eliminated when the ratio was considered. The *PHr* was statistically significant ( $p < 0.001$ ) as an age estimate. Gender was not significantly correlated with age; therefore, it was excluded from the linear regression formula for age estimation. The highest accuracy for age estimation was obtained for the study cohort aged between 30 years and 59 years. The age estimation error for other age-group cohorts is comparable with errors reported by other dental methods for age estimation.

**Conclusion:** The outcomes of this study indicate that pulp chamber volume narrowing is a reliable parameter for estimating the age of living adults, and CBCT is an easy and conservative approach that enables accurate calculation of dental tissue volumes. The proposed approach reduces the operating time compared to other techniques, which also are more complex and expensive. The results were validated by comparing the calculated volumes with the physically measured real volumes, which indicates that the experimental approach is accurate. The inter-observer agreement (Intra-Class Correlation Coefficient (ICC) 0.99) was excellent, which demonstrates that the method is highly reproducible.

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**Forensic Odontology, Age Estimation, Cone Beam Computed Tomography**

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