



### F41 Age Estimation From Progressive Changes in Dental Pulp Chambers

*Charles E. Berner, DDS\*, Charles E. Berner, DDS, Inc., 5564 Wilson Mills Road, Cleveland, Ohio 44143; and Paula C. Brumit, DDS, Bruce A. Schrader, DDS, and David R. Senn, DDS, Center for Education and Research (C.E.R.F.), UTHSCSA-Dental School, Mail Code 7919, 7703 Floyd Curl Drive., San Antonio, TX 78229-3900*

The goal of this presentation is to add data to the postulate that examination of secondary pulp formation can be done radiographically and thus be applicable as a noninvasive indicator for both the living and deceased in adult human age estimation.

This presentation will impact the forensic community and/or humanity by demonstrating a noninvasive examination of teeth using radiographs in both living and deceased individuals as a means of age estimation.

Several methods of age estimation are available to forensic scientists and it is beneficial when multiple modalities can be used to further narrow ranges or reinforce conclusions. Some established methodologies are limited to postmortem examination. Some methods of age estimation, e.g., radiographs of epiphyseal development, pubic topography, suture line closure, lipping of vertebrae, etc., may be compromised or impossible to apply if remains are fragmentary. Teeth often survive extremes of time and trauma. Studies have shown that the size of the dental pulp chamber is reduced with advancing age as a result of secondary dentin deposition by the pulp. In this effort to evaluate a correlation between pulp chamber size and an individual's age, the premise investigated within this study suggests a noninvasive examination of teeth using radiographs in both living and deceased individuals as a means of age estimation.

This study reexamines work presented by Kvaal, et al, and adds data to the postulate that the examination of secondary pulp formation can be done radiographically and is thus, applicable as a noninvasive indicator for both the living and deceased in adult human age estimation. The design of this study parallels the technique and parameters described in Kvaal's paper in *Forensic Science International*, Vol. 74, Issue 3, 28 July 1995, Pages 175-185. This study is an effort to further validate or challenge the earlier reported findings. The study material for the current project was date-labeled periapical radiographs of 100 patients of known age from one author's private dental practice. Full mouth radiographic images were photographed on a standard view box with a Fuji Pro S2 digital camera, tripod, and remote shutter cable switch. Adobe Photoshop CS software features were used for enhancement, magnification and measurements. The selected radiographs were of the six types of teeth selected in the Kvaal study: maxillary central and lateral incisors and second premolars, and mandibular lateral incisors, canines and first premolars. Subjects with a history of missing target teeth were excluded from this study and individuals with restorations in the target teeth were also excluded from this study to avoid the introduction of reparative dentin variables skewing the results. The evaluation of several teeth from the same individual also contributed data regarding whether specific teeth have a stronger association between secondary dentin formation and age. Several ratios of defined pulp dimensions (established in the earlier study) to overall tooth morphology were calculated for the defined target teeth. Ratios were used rather than direct measurements to reduce the impact of variation in magnification and angulations of the radiographs. Statistical analyses were used to validate or discount the significance of Pearson's correlation coefficient between age and the different ratios for each type of tooth. Principle component analyses were performed on all ratios. Regression analyses were also calculated. The calculated values were studied for strength, weakness, or statistical relevance/significance to the age of the individual.

The coefficient of determination was strongest when all ratios from the six teeth were included in the mean and weakest when only the mean values of the ratios from one tooth were included. As stated earlier, obtaining more extensive information for each individual results in age estimation with a narrower range. These findings support previous studies that show the advantage of pulp/tooth ratio analysis over root/tooth ratio analysis as an age estimation method.

Additional data should be developed through studying a larger volume of subjects. Studies are also needed on specific populations.

**Age Estimation, Forensic Odontology, Dental Pulp Chamber**