



F32 Dental Age Estimation by Calculating the Ratio of Tooth and Pulp Volumes Using Cone Beam Computed Tomography

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At the end of this presentation, participants will appreciate the value of the cone beam computed tomography in dental age estimation methods.

Estimation of age using cone beam computed tomography will be an adjunct to other age estimation techniques in identifying unknown individuals and assisting law enforcement officials in determining whether individuals have reached the legal age of adulthood.

Age estimation is an important factor in the identification of unknown individuals and integral in efforts to assist officials in determining whether individuals have reached the legal age of adulthood. The most common dental age estimation methods currently used are based on various age related changes in teeth. The methods that utilize formation and development of teeth are accurate for estimating ages in children and adolescents but ineffective for adults. Some of the methods useful for adults require the extraction and sectioning of teeth and are not applicable for living individuals. Morse (1991) and Kvaal et al (1995) discussed assessing the reduction in the volume of the pulp with increasing age for age estimation. The current study focuses on evaluating the tooth-pulp volume ratio (vT:vP) using images obtained from cone beam computed tomography (CBCT). The CBCT method may allow for a more accurate assessment of the tooth and pulp volumes than the two dimensional information provided by radiographs.

Using a Morita 3D Accuitomo Model, 150 images of 150 individuals of known ages were collected. The target teeth chosen for this study were paired maxillary incisors, maxillary first permanent molars and mandibular first permanent molars. The participants had at least one pair of target teeth, fully developed, and with no evidence of restoration/pathology.

For single rooted teeth the most coronal extent of the pulp and the location of the root tip were determined. Segments representing eighty per cent (80%), forty per cent (40%) and twenty per cent (20%) of the most coronal portions of the pulp tip to root tip portions of these teeth were analyzed. These selection criteria exclude that portion of the crowns with no pulp and a calculated portion of the root tip. The volume measurement for the mandibular first permanent molars was from the plane parallel to the tip of the most coronal pulp horn to the plane parallel to the most coronal portion of the furcation of the root with both planes perpendicular to the estimated long axis of the tooth. A second volume measurement for the mandibular molars included the initial volumes added to volumes calculated for a segment of the root portions of the tooth equal to the initial segment. For the maxillary first permanent molars, the area of interest extended from the plane even with the tip of the most coronal pulp horn to the plane even with the most coronal portion of either root furcation. CBCT slices of known thickness were imported into Adobe Photoshop for area measurements of the tooth and the pulp. The volume was calculated by multiplying the tooth area and pulp area of each slice by the thickness of the slices. The sums of the vT and vP for all the slices included for each tooth was determined and the vT:vP was calculated.

The distributions of each set of vT:vP were tested for normality, and the angular transformation was applied when necessary. Linear regression was performed to determine the overall association of subject age with each set of vT:vP values. The subjects were then grouped by decade age, and one-way ANOVA tests were performed to determine if any significant mean differences between decade ages were observed, with the F-tests considered statistically significant if $p < 0.01$. If the F-test was significant, then pairwise decade age mean comparisons of interest were performed using Bonferroni-adjusted Student's t-tests with $p < 0.05$ considered statistically significant. The sample size of 20 subjects per decade age grouping was sufficient to detect a population effect size of 0.4 or more by F-test at the 0.01 level with power of 80%. The specific results of this study will be presented.

Forensic Odontology, Age Estimation, Cone Beam Computed Tomography