

THE DETERMINATION OF AGE AT DEATH THROUGH THE EXAMINATION OF ROOT TRANSPARENCY

Jennifer L. Harms

ABSTRACT of a Master's Thesis in Human Biology at the University of Indianapolis
filed September 2004

Dr. Christopher W. Schmidt, Chair
Dr. Stephen P. Nawrocki, Reader

An essential component in the creation of a biological profile in forensic and bioarchaeological casework is the determination of age at death of an individual. Progressive and regressive morphological changes in dental tissues can be used to assess age at death. Development and eruption of the teeth is fairly predictable and can be useful into the early twenties. Once the complete dentition has moved into occlusion, however, other aging methods must be utilized. Alternative dental techniques such as measures of attrition, cementum annulation, and root transparency can be applied to older individuals.

Root transparency has been shown to predict an individual's age when used in conjunction with other age-related dental traits and also when it is used as a sole predictor. Since root transparency does not begin to develop until approximately the third decade of life, its contribution to the assessment of aging older individuals is potentially important. Root transparency is an age-related phenomenon that develops as the dentin tubules within a tooth root begin to mineralize from the root apex towards the crown. This mineralization is a result of calcium salts forming in and around the tubules, consequently increasing the amount of translucent dentin that can be visualized grossly.

Root transparency can be examined histologically or macroscopically. Histological analyses require that teeth be ground into thin sections, which can be a concern in instances where the specimen must be returned intact or when additional characteristics of the tooth must be studied from a complete specimen. A less invasive method is the macroscopic analysis of root transparency of intact teeth, thus preserving them for further study.

The current study will re-evaluate the methods and statistical analysis of root transparency on intact teeth as developed by previous investigators, such as Bang and Ramm (1970). Relative and absolute root transparency values are measured in millimeters with digital sliding calipers as the tooth is held in front of a constant light source. Medical cadaver teeth are used because the individuals have known ages at death and sex. All cadavers were housed at universities in Illinois, Indiana, Michigan, and Ohio. One hundred five teeth from 32 male cadavers and 175 teeth from 50 females made up the current study sample. The total age range extends from 29 to 100 years, and the mean age of the entire sample is 77.4 years. On average, four teeth were removed from each cadaver representing anterior, posterior, maxillary, and mandibular regions of the dentition.

The data indicate that age affects variation in root transparency but that sex does not. Correlation coefficients for each tooth and several combinations of teeth indicate that 10 variables showed the strongest correlations with age, and only these variables were used in subsequent analyses. These variables include the transparency of upper right canines, lower right canines, right canines, all canines, right third premolars, all third premolars, all fourth premolars, all anterior teeth, all posterior

teeth, and all teeth combined. Linear regression equations were created for each of the 10 variables, producing standard errors ranging from +11.519 to +14.542 years. An intra-observer test of error in measuring transparency resulted in a correlation coefficient of 0.514 at a level of significance of $p = 0.004$, indicating that the technique is somewhat difficult to repeat. This low reliability could have affected the conclusions of the study in that an increase in unsystematic measurement error may have artificially deflated correlation coefficients and led to the removal of otherwise significant variables from consideration. In sum, while some studies have shown that root transparency can be useful in estimating age at death, this study found the method to be less easily applied and less reliable than previously reported.

Copyright © 2004 by Jennifer L. Harms

The author grants permission for this document to be copied and distributed for personal and educational use as long as proper citation is given. Commercial use of this document is forbidden without the prior consent of the author.

Suggested citation of this document: Harms J (2004). The Determination of Age at Death through the Examination of Root Transparency (abstract). University of Indianapolis Archeology & Forensics Laboratory (<http://archlab.uindy.edu>).

Last update 6-30-06