



Physical Anthropology Section – 2005

H8 Analysis of Season at Death Using Cementum Increment Analysis

Vicki L. Wedel, MA*, and Joshua B. Peabody, MA*, University of California, Santa Cruz, Department of Anthropology, 1156 High Street, Social Sciences 1 Faculty Services, Room 361, Santa Cruz, CA 95064

The goal of this research project is to test the efficacy of using dental cementum to determine the time of year in which the death of an individual occurred (season-of-death). The biological basis of the project, materials and methods used, and the need for and benefits of the data produced are discussed.

This presentation will impact the forensic community and/or humanity by seeking to identify the timing of dental cementum increment formation in humans and thus provide a means by which season-of-death could be determined in forensic cases.

The forensic anthropologist's examination of skeletal material usually includes determination of the biological profile (age at death, sex, ancestry, and stature), estimation of postmortem interval, and detection of any trauma/pathology and its timing relative to the death. At present, estimates of postmortem interval, the amount of time that lapsed between death and discovery, are based on state of decomposition of the remains and their associated ecological conditions, and are generally given in broad ranges of months to years. Cementum increment analysis in humans has the potential to help narrow the estimate of postmortem interval to the actual calendar year and season during which the individual died. This project applies proven methods for determining season-of-death among mammals to the analysis of human teeth. Although age at death studies have been conducted, no known study has attempted to apply these methods to season of death. The theoretical underpinnings that make it possible to determine the time of year that an animal died simply from the microstructures in its teeth are the same for animals and human beings, and therefore a successful outcome is anticipated.

Dental increments are identified in the cementum deposits on the roots of human teeth and under microscopic examination appear as alternating dark and light bands, analogous to tree rings. Research with comparative samples of known-age and known date-of-death individuals has demonstrated a consistent relationship between annual seasons and the formation of distinct increment types. In general, the winter or arrested cementum increment appears as an opaque band while the summer or growth increment appears as a translucent band. Together these represent one year of an individual's life, providing an annual record of that person's life history. The total number of increments provides a means of determining the individual's age at death (Wittwer-Backofen 2004, Kagerer and Grupe 2001, Jankauskas *et al.* 2001, Geuser *et al.* 1999).

Methods of increment analysis are broadly similar. Increments are exposed by sectioning teeth and grinding or polishing the cut surfaces, which are then viewed under magnification. Research into the biology of cementum formation (Lieberman *et al.* 1992; Lieberman 1993) suggests that the petrographic method of sectioning is most appropriate for both archaeological samples and comparative samples because it takes advantage of changes in polarized light diffraction resulting from biological variation in the structure of cementum increments. With the petrographic method, teeth are embedded in either an epoxy or plastic matrix to help maintain the structural integrity of the tooth, thin sections are cut with a low speed saw fitted with a diamond blade, mounted on glass slides, and then ground and polished. Thin sections are viewed under 125X magnification with a transmitted, polarized light source. Cementum increments are counted and measured for thickness.

For this investigation, the authors have acquired extracted teeth, the individual's date of birth, and date of extraction from local dentists. Recent studies involving human teeth (Wittwer-Backofen 2004, Kagerer and Grupe 2001, Jankauskas *et al.* 2001, Geuser *et al.* 1999) have indicated that no statistical difference exists in cementum accumulation of different teeth within a single individual. For this reason a specific tooth was not required.

Precise interpretation of dental increments is predicated upon establishing seasonal formation times in the particular taxon under analysis. In the case of humans, no comparative study has recorded the specific timing of increment formation. The current project seeks to identify the timing of increment formation in humans and thus provide a means by which season-of-death could be determined in forensic cases. Results of the pilot study will be presented in this report.

Cementum Increment Analysis, Dental Anthropology, Season at Death