H47 How to Look a Gift Corpse in the Mouth: Season at Death Determined by Cementum Increment Analysis

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After attending this presentation, attendees will learn how dental cementum increment analysis can help forensic anthropologists narrow their estimates of postmortem interval.

This presentation will impact the forensic community and/or humanity by helping forensic anthropologists using this technique to be able to better assist law enforcement in determining time since death.

Forensic anthropologists are often called upon to estimate time since death in the analyses of decomposing and skeletonized human remains. Estimates are based on the overall condition of the remains, the presence of insect activity, and the decomposition microenvironment. Postmortem interval estimates are usually expressed as broad ranges of months or years, especially when forensic anthropologists are not present at the time of recovery. Dental cementum increment analysis could help us make much more specific determinations.

Dental cementum anchors teeth into their sockets via the periodontal ligament. 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).

Zooarchaeologists have long used dental cementum increment analysis to estimate season at death in mammals (Pike-Tay 1991; Lubinski and O'Brien 2001), yet the authors are aware of no study to date that has tested this method in humans. The current project seeks to identify the timing of increment formation in humans and thus provide a means by which seasonof-death could be determined in forensic cases. Once the transition periods are identified, they can be correlated to seasons of the year.

A pilot study for which extracted teeth were donated by the patients of Santa Cruz oral surgeon Dr. Erick Eklund was conducted. Each tooth was cleaned and embedded in Buehler Epoxide. Embedded teeth were sectioned to a thickness of 400 microns, mounted to glass slides, and ground and polished. The polished sections were viewed under 125X magnification and transmitted polarized light using an Olympus BX40 light microscope. Digital photographs were taken using a Nikon D70 SLR camera mounted directly to the microscope. Once the outer (nascent) band was identified, the widths of like bands were measured and averaged in Adobe Photoshop. The thickness of the outer band was divided by this average thickness to determine the percent growth. For example, if the outer band was translucent, its width was divided by the average thickness of the other translucent bands present in the section.

An outer increment 75-100% complete marked the end of the growth cycle. An increment 50-75% complete indicated growth three-quarters completed, 25-50% complete half completed, and 0-25% just beginning. The pilot study results indicate that dental increments are visible on cross sections of human teeth, and they appear to vacillate between opaque and translucent in regular cycles. Preliminary data suggest that the transition between the growth (translucent) and dormant (opaque) seasons occurs between August and October. Teeth extracted during these months have nearly complete outer translucent increments. Teeth extracted between November and January has newly visible opaque outer increments. It appears that the translucent increment is completely formed by late September or early October, with the opaque increment beginning to form immediately following and visible under magnification by the second week of October.

Dental cementum increment analysis for estimations of season at death shows great potential for use in forensic anthropology. Teeth are very durable and are commonly recovered, even at death scenes where bone tissue quality is poor, advanced mummification or fragmentation is present, or cremation has occurred. As such, one full calendar year's worth of samples needs to be examined, and the sample size needs to be expanded. At present, the method appears most effective in middle to older aged adults, as the increments are more clearly identified than in adolescents and early adulthood when some of the dentition has only recently erupted.

Postmortem Interval, Dental Cementum, Season at Death

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