F6 Using Dental Cementum Increments to Determine Season at Death

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After attending this presentation, attendees will understand how dental cementum increments can refine estimates of postmortem interval.

This presentation will impact the forensic science community by exploring how the development of new scientific methods is crucial to the further advancement of forensic science. In this presentation, a method of determining season at death in human skeletal remains is described. Once a validation study of this new method is completed, odontologists and anthropologists will be able to provide more information to aid in the identification of unknown remains.

Forensic anthropologists are often called upon to estimate time since death when analyzing 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 has the potential to help us be much more specific in our determinations. Dental cementum anchors teeth into their sockets via the periodontal ligament. The main components of cementum are collagen bundles that become mineralized by hydroxyapatite crystals. Cementum is first laid down immediately before the tooth erupts and additional layers are added throughout life. During cementum formation, hypermineralized layers of extracellular matrix alternate with less mineralized layers, creating 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. The winter or arrested cementum increment appears under polarized light as an opaque band while the summer or growth increment appears as a translucent band. Together these bands represent one year of an individual's life. The total number of pairs of opaque and translucent increments provides a means of determining the individual's age at death within two and one half year ranges of error. To derive age at death, the number of pairs of bands is added to the age at which the tooth is known to erupt.

Zoo archaeologists have long used dental cementum increment analysis to estimate season at death in other mammals, yet the method has been little tested in humans. In this recently completed pilot study, the method of dental cementum increment analysis is extended to humans for the first time. Extracted teeth were donated by dental patients, and date of extraction was used as a proxy for date of death. The participating dentist also recorded the patient's date of birth. Teeth were assigned random sample numbers and were then cleaned and embedded. Thin sections were cut using a low speed saw, the wafers were mounted on petrographic slides, and ground to a thickness of approximately 100 microns. After being polished, the sections were viewed under transmitted polarized light, and the outer cementum increment was identified.

The pilot study revealed that the translucent and opaque bands did correlate with dates of extraction. Translucent bands were significantly correlated ($p<0.001$) with dates of extraction between April and October. Opaque bands were significantly correlated ($p<0.001$) with dates of extraction between October and April. Teeth were effectively sorted by season 99% of the time. Further, both translucent and opaque bands increased in thickness incrementally from the beginning to the end of the respective season ($p<0.001$). This indicates the possibility that with a large enough sample, the seasons might be refined even further from two six-month periods to four three month periods. The results of the pilot study will be discussed here, and the application of the technique to several forensic cases will be described.

Postmortem Interval, Dental Cementum, Odontology

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