



A18 Reassessing Determining Season at Death Using Dental Cementum Increment Analysis (DCIA) in Young Adults

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Learning Overview: After attending this presentation, attendees will be familiar with the method used to determine season at death using DCIA, presented with a reassessment of seminal (2007) data in comparison to data from two current studies. Attendees will be able to appreciate the methodological, histological, and microscopy skills necessary to apply this method.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing updated accuracy rates, as well as recommendations for the technological setup and analysis of dental cementum increment for season-of-death determination. This will inform future histological research, resulting in higher quality forensic research and practice.

In 2007, Wedel published a study in which dental cementum increments, or annulations, were examined in 112 teeth extracted from consenting oral surgery patients from Santa Cruz, CA.¹ Wedel reported that the season in which the tooth had been extracted (a proxy for date of death) could be determined to be between April-September (spring/summer) or October-March (fall/winter), with 99% accuracy.¹ The method used had been adapted from zooarchaeology and involved embedding the teeth, sectioning them on a low-speed saw, grinding and polishing the sections to 100 microns in thickness, examining them under transmitted, polarized light, and determining whether the outermost band was optically bright (spring/summer) or opaque (fall/winter).

Since 2007, others, including Meckel and Wescott, have attempted to replicate Wedel's results and been unable to achieve the 99% accuracy rate.² Meckel and Wescott report a 60% first-time and an 18% second-read accuracy rate from their analysis of teeth taken from 24 individuals aged greater than 50 years.² However, Meckel and Wescott did achieve accurate assessments of death in teeth from two individuals aged less than 22-years.² Meckel and Wescott urge caution in applying the method to teeth from individuals greater than 50 years of age but were optimistic that the method could be used in young adults.²

To look for corroborating or contrasting evidence of their results, this study re-examined teeth collected from the 18-25-year-old individuals in Wedel's original study. It is hypothesized that the outermost optically active annulation of extrinsic cementum can be distinguished from the outer edge of the tooth, and that the original seasons noted by Wedel will be distinguishable in this study as well.¹

Forty teeth were available for this study, from which accurate assessments of season at death were made in 31 cases, for an accuracy rate of 78%. Two teeth were deemed indeterminate because of abnormal tooth histology, and this study was incorrect in its assessments of season in seven instances, five of which were teeth from transitional periods: late March through early April and late September through early October. This study, authored by two experienced hard-tissue histologists, agreed on all but 3 of the 38 teeth for which season was assessed, yielding an inter-observer agreement rate of 92%.

This presentation proposes to detail the fine-tunings of working with optically active tissue at the curved or obliquely oriented tooth edge using the polarized light and the fine focus mechanisms at 100x magnification. Included in the discussion will be the optimal tooth locations to observe the outermost band of optically active acellular extrinsic fiber cementum, in addition to limitations of applying this highly technical method to human teeth. Reasons for discrepancies between Wedel's and these results will be discussed, as will be the differences between this sample and Meckel and Wescott's sample.^{1,2}

Reference(s):

1. Wedel, V.L. 2007. Determination of Season at Death Using Dental Cementum Increment Analysis. *J Forensic Sci.* 52(6): 1334-1337.
2. Meckel, L.A., Wescott, D.J. 2017. The Utility of Dental Cementum Increment Analysis for Estimating Season-of-Death in Naturally Decomposed Skeletons. Poster presented at the 87th Annual Meeting of the American Association of Physical Anthropologists-Austin, TX.

Dental Cementum Increment Analysis, Season at Death, Dental Histology