G42 Cementum Annuli: Technique, Microscopy, and Assessment of Age

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Learning Overview: After attending this presentation, attendees will understand: (1) the method of dental cementum thin section preparation of forensic teeth; (2) the microscopic analysis necessary to assess age via band qualification and quantification; and (3) age assessment methods.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by increasing understanding of the techniques and methods. Attendees will be able to initiate the cementum annuli age assessment technique using microscopy in cases of partial representation of the dentition and skeleton.

Mineralized tissue, particularly the dentition, possess superb postmortem longevity. In certain wildlife such as bears and wolves, cementum annuli counts have been considered one of the most accurate indicators of age. While cementum annuli studies of zooarchaeological and modern wildlife are well documented, application to human teeth has been histologically and methodologically far less successful, preventing standardization and utilization. However, recent research indicates that cementum annuli may be used more reliably than any other part of skeletal remains to accurately determine age.

This study documents the laboratory preparation and enumeration of cementum structure on all tooth types and root locations using dissecting, light, and scanning electron microscopy. Teeth that were extracted because of periodontal disease, orthodontic, and prosthetic reasons were used in this study. The extractions (n=108) from several general dental and oral and maxillofacial practices were documented with age, sex, and ancestry. All deciduous and permanent tooth types were embedded, thin sectioned (whole tooth, labiolingual and root, transverse, and mesio-distal), ground, polished, and etched or stained. Select intra- and inter-root locations (i.e., cervical, mid-root, apical, and inter-radicular) were examined. At low magnification, the dissecting microscope at 5X–10X was utilized to assess cementum quality, thickness, and root coverage. At high magnification, the scanning electron microscope at 100X–200X documented the structural reality of annuli and not for the counting procedure for age estimation. The light microscope at 25X–50X provides the tool for annuli counting in assessment of age.

Light microscopy of the mid-root area, regardless of the molar's mesial or distal root or tooth type, revealed the most easily visualized annuli for quantification. The cervical region is many times damaged or thinned from periodontal events, and the thickened apical region display a more "confusing" and unassignable array of annuli.

Countable cementum annuli are present in human teeth. Images of the annuli in the form of dark and transparent bands were counted using image analysis software to arrive at an age estimation. The average number of years of eruption for each tooth were added to the annuli count. Results helped determine the best methods to count the cementum annuli while also showing a significant correlation between the annuli count, predicted age, and actual chronologic age of each individual. Further studies are needed to help determine the environmental effects such as climate, temperature, and length of day on the production of the annuli in different populations.

Cementum, Age, Microscopy

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