## G35 The Analyses of Dental Remains From 1607 Jamestown, Virginia, Using Micro-Computed Tomography (micro-CT) Imaging, Scanning Electron Microscopy With Energy-Dispersive X-Ray Spectroscopy (SEM-EDX)/Raman Spectroscopy (RS), and Paleobotany

*Barry Pass, PhD*, Howard University, College of Dentistry, 600 W Street, NW, Washington, DC 20059; Martin D. Levin, DDS*, University of Pennsylvania, Department of Endodontics, School of Dental Medicine, Philadelphia, PA 19104; David J. Cohen, MD, Virginia Commonwealth University, Department of Biomedical Engineering, School of Engineering, Richmond, VA 23284; Zvi Schwartz, PhD, Virginia Commonwealth University, Department of Biomedical Engineering, School of Engineering, Richmond, VA 23284; Barbara D. Boyan, PhD, Virginia Commonwealth University, Department of Biomedical Engineering, School of Engineering, Richmond, VA 23284; Dimitry Pestov, PhD, Virginia Commonwealth University, Department of Biomedical Engineering, School of Engineering, Richmond, VA 23284; David Givens, MSc, Preservation Virginia-Jamestown Rediscovery, 1365 Colonial Parkway, Jamestown, VA 23081; Michael Lavin, BSc, Preservation Virginia-Jamestown Rediscovery, 1365 Colonial Parkway, Jamestown, VA 23081; Linda Scott-Cummings, PhD, PaleoResearch Institute, 2675 Youngfield Street, Golden, CO 80401; and Douglas W. Owsley, PhD, National Museum Natural History, Dept of Anthropology, PO Box 37012, MRC 112, Washington, DC 20013-7012*

After attending this presentation, attendees will be familiar with advanced radiographic imaging and spectroscopic and paleobotanical techniques for analyzing skeletal and dental remains in order to reconstruct details of a deceased person's life and to determine events prior to and surrounding death and burial.

This presentation will impact the forensic science community by demonstrating how evidence-based science and technology can improve efficiency, quality, accuracy, reliability, and functional excellence in forensic sciences.

The first English settlement in North America was established in 1607, at Jamestown, VA. The first casualty in Jamestown was a 15-year-old boy (specimen 1225B), the apparent victim of an Indian attack.[1] His excavated remains reveal an arrowhead at the thigh, broken left collarbone, and anterior mandible with Ellis Type III fracture of mandibular left central incisor (#24), with significant periapical pathological bone resorption.

The objectives of this multidisciplinary study are to elucidate the nature and chronology of odontogenic cause(s) of mandibular pathosis evident in 1225B skeletal remains, and analyze contents of fractured teeth root canals to assist assembling a corporeal and physiological history.

In this study the following technologies were used: Cone Beam Computed Tomography (CBCT) for morphological and chronological assessment of 1225B skull; 3D intraoral visual imager to non-invasively examine and manipulate occlusion; 2D intraoral X-rays to document individual teeth; micro-CT (mCT) to image intact and fractured teeth and root canals; Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDX), and confocal Raman Spectroscopy (RS) for nanoscale imaging and elemental analysis of root canal particulate and soil surrounding skeletal remains; focus stacking light microscopy for spatial assessment of carious lesion; and polarized light microscopy for analyzing root canal contents of fractured tooth.[2-4]

MCT of fractured tooth #24 revealed arrested root canal maturation and established the boy's age as eight years old at the time of the trauma to anterior dentition; CBCT scans were consistent with the presence of mandibular, intra-

alveolar pathosis for seven years of age; SEM/EDX and RS established the organic nature of #24 canal particulate, of possible fungal origin; intraoral imager supported the feasibility of reconstructing the fragmented cranial base; transmitted light microscopy of root canal contents indicated the presence of cerealia, tree pollen, starch, and fungal hyphae.[5] Polarized light microscopy clarified starch identifications.

In conclusion, this research demonstrated the effectiveness of using evidenced-based technology to reconstruct cause and chronology for disease processes and death from skeletal remains. Future research: refine and expand preliminary studies; plaque and canal particulate analyses using lipid studies and Next Generation Sequencing (NGS); comparison of 1607 and current plaque compositions; digital reconstruction of the cranial base for orthodontic analyses; evaluation of skeletal remains for evidence of scurvy, periodontal disease, and skeletal growth plate deficiencies; multi-disciplinary analysis of grave-site soil adjacent to critical anatomy; excavation of adjacent Jamestown adolescent's grave for comparison studies.[6]

**Reference(s):**


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**Teeth, micro-CT, Spectroscopy**