

Energy Dispersive X-ray Spectroscopy of 19th-Century Dental Fillings

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This presentation examines the history of American dental care from the Colonial period through the end of the 19th-century as observed in human skeletons from archaeologically excavated burials. Dental disease had a major impact on health and quality of life. As a component of bioarchaeological examinations, oral health and dental pathology are routinely assessed through observations that track the incidence of tooth decay, abscesses, antemortem loss of teeth, and periodontal disease.

By the 1840s, professional dental care was becoming available to individuals of higher socioeconomic status. It was not common in the general population. About 275 dental fillings and a few partial bridges and complete dentures have been examined. Cavities were filled with pure gold and other metallic restorations. Specific details about the composition of these alloys are lacking.

As a means of tracking material use by the developing dental profession, we undertook a material science investigation of dental fillings. It began with X-ray fluorescence as part of a reconnaissance survey and progressed to variable-pressure SEM-based energy dispersive x-ray spectroscopy for elemental analysis. The analyses reflect a transition from gold to metal alloys during the last half of the century. These amalgams, some analytically challenging, varied greatly in composition and differed in quality. Identified elements include gold, silver, tin, mercury, copper, arsenic, lead, zinc, bismuth and chlorine.

The observed occurrence of dental restorations increased over time with the exception of the 1870s, a pattern that likely reflects decreased availability of certain metals and economic hardship during and following the Civil War. The commanding officer of the Confederate submarine, the *H.L. Hunley*, provides a wartime example of suspected treatment with poor-quality dental fillings.

In addition to providing information on the chemical compositions of these fillings, microscopy yielded insight into the methods of dental restoration.