F34 A Comparison Between Restorative and Flowable Resins at Varying Temperatures Using X-Ray Fluorescence

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The goals of this presentation are to describe: (1) the uniqueness of inorganic properties of various resin materials; (2) the change in properties of resins when exposed to high temperatures; and, (3) the significance of these findings as they relate to victim identification.

This presentation will impact the forensic science community by increasing understanding of how documentation in the dental chart of the brand names of the restorative materials used is critical and may further strengthen the ability to provide positive identifications of remains.

With cosmetic dentistry becoming more in demand, the use of amalgam has steadily declined over the past decade. Although more esthetically pleasing, resin composite restorations pose a unique challenge to the forensic dentist when it comes to identifying remains, as they can be difficult to see clinically and on radiographs. If the remains have been incinerated, visual identification of restorations becomes even more challenging. Resin composites are comprised of two primary components: organic monomers and inorganic fillers. It has been shown that the inorganic composition is, for the most part, unique to the brand.[1] The use of an SEM with Energy Dispersive X-ray Spectroscopy (SEM/EDS) has proven useful in identifying the elemental composition of specific resin restorative materials.[2] However, the SEM/EDS is a large machine, and it is not practical for a field or morgue setting. A portable X-ray Fluorescence spectrometer (XRF) can be used to overcome this challenge, and still correctly identify resin composition.[3] This table clinic will use XRF to determine compositional differences among three brands of conventional and flowable resin composite materials at various temperatures.

Three brands of conventional and flowable resin composites were chosen: Filtek Supreme (3M ESPE), Esthet-X (Dentsply), and TPH3 (Dentsply). Twelve disks of resin material (two from each type/brand), 1cm in diameter, were prepared and cured according to manufacturer's instructions. Six individual disks (one from each type/brand) were then placed in a ceramic crucible and placed in a burnout oven and heated from room temperature to 300°C, 600°C, and 900°C, with a 30 minute hold at each temperature. The portable XRF was scanned over the disks both at room temperature and after being heated at each of the three target temperatures. The X-ray spectra were compared to the control disks and to the manufacturer's stated elemental compositions.

Dental identification can be challenging in the best of circumstances. When remains are incinerated, the ability to obtain fingerprints and DNA is either gone or greatly diminished. This places the burden of scientific proof on the forensic dentist. The antemortem dental record, including both written text and radiographs, is an absolutely critical piece of the identification puzzle. Because the inorganic components of resin composites are unique to the type and brand of material, accurate documentation in the dental chart of the brand names of the restorative materials used is critical, and may further strengthen the ability to provide positive identifications of remains.

References:

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3. Bush MA, Miller RG, Prutsman-Pfeiffer J, Bush PJ; Identification through X-ray fluorescence analysis of dental restorative resin materials: a comprehensive study of noncremated, cremated, and processed-cremated individuals. J Forensic Sci. 2007 Jan; 52(1):157-65.

X-Ray Fluorescence, Resins, Dental ID

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