



### **F42 Practical Update in UV LED Fluorescent Light Restoration Detection: Science and Casework**

*Peter J. Bush, BS\*, Laboratory for Forensic Odontology Research, School of Dental Medicine, SUNY at Buffalo, B1 Squire Hall, South Campus, Buffalo, NY 14214; Gerald Guzy, DDS, 259 Kinderkamack Road, Westwood, NJ 07675; Arnold S. Hermanson, DDS, 4121 West 83rd, Suite 220, Prairie Village, KS 66208; and Mary A. Bush, DDS, SUNY at Buffalo, B1 Squire Hall, 3435 Main Street, Buffalo, NY 14214*

The goal of this presentation is to inform and update the forensic odontologist of the potential benefits and pitfalls of using an ultra violet light emitting diode (UV LED) light for composite resin and dental restoration detection.

This presentation will impact the forensic community by describing the practical circumstances in which UV LED light dental inspection can be effective.

Composite resin restorations whose shades are well matched to that of teeth and are contoured to be anatomically correct may be difficult to recognize by visual inspection or tactile inspection. Even radiographically, these restorations may not be apparent. This problem is evident in postmortem charting for the forensic odontologists. Teeth naturally fluoresce when exposed to sunlight. This affect has encouraged many manufacturers to add compounds to mimic this property in the composite resin. The result is a wide variety of materials that exhibit varying fluorescent properties that range from no fluorescence to that similar to tooth structure, or much brighter than tooth structure.

A technique using LED UV light was introduced as an aid in composite resin detection at the 2006 AAFS Annual Scientific Meeting. The use of this method can greatly enhance the visual detection of restorations that may otherwise go unnoticed. Many forensic odontologists now include UV flashlights as standard equipment in their forensic armamentarium. However, there have been subsequent questions involving casework in which materials present did not respond to UV illumination. There are several instances in which UV LED light may not produce expected results.

Since dental materials, including porcelains, possess varying degrees of fluorescence properties it is important to understand what the potential limitations of using a UV LED light may be. There are also circumstances that contribute to these limitations, such as instances that involve incineration. Resin material will lose fluorescent properties at a fairly low temperature. This temperature range was determined to be around 300C. Thus, with the wide range of visual results likely with the use of a UV LED light, a spectroscopic study was performed to determine the range of these possibilities.

Twenty-four brands of modern composite resin were evaluated. Discs of resin, 1.7mm in thickness and 1cm in diameter, were prepared between two glass plates and polymerized according to manufacturers directions. Fluorescence spectroscopy was performed on each disc using a UV-Visible light spectrofluorometer (SLM 8100 Spectrofluorometer). The fluorescence intensity maxima and emission maxima of the composite resins was determined. Control samples of dentin and enamel were also measured. The spectral distributions and intensities of flashlights with different LED configurations and wavelengths were also analyzed. The optimal wavelength for LED light inspection was determined to be 395nm. The relative fluorescent properties of the composite resin were documented. The resins were subsequently placed in extracted teeth and the tooth/material exposed to 395nm UV LED light and the results photographed and documented with the aid of a stereomicroscope.

Results indicated that several manufacturers incorporate a fluorescing agent that mimics tooth structure exactly. In this situation there will be no visible contrast between the resin and the enamel. This may lead to a false negative result if the UV LED light technique is used. It is important when using a procedure to be aware of limitations that may exist. The pros and cons of UV LED light will be discussed, and case studies will be presented.

#### **Forensic Odontology, Fluorescence, UV LED**