Characterizing Tooth Decay with Fluorescence

Introduction

Quick and quantitative analytical evaluation of tooth decay is required in any study of the environmental factors promoting such decay. This information is essential to any study of which dental products are most effective in slowing or arresting the decay.

Teeth are naturally fluorescent solids, and are highly-scattering samples that can introduce interference that would mask fluorescence indicators. Thus, a SPEX® FLUOROLOG® spectrofluorometer was selected, taking advantage of double monochromators for ultra-pure spectra. Use of a FLUOROLOG® allowed picosecond time-discrimination via the FLUOROLOG®-Tau lifetime accessory for even more information about the samples.

Results

Fig. 1 shows a contour plot of the excitation-emission matrix of the sample. The plot results from scanning the fluorescence at various excitation wavelengths. The clean enamel surface exhibited two large fluorescence bands at 430 and 470 nm.

Fig. 2 shows a surface heavily damaged by decay. Though the 430- and 470-nm peaks were still present, their relative intensities were reversed. In addition, a new peak surfaced at 650 nm. Lifetime data from the FLUOROLOG®-Tau confirmed that there was indeed a third component present at 650 nm, with a long lifetime of about 600 ns.

Conclusion

The FLUOROLOG® system provides a quantitative assessment of tooth decay, via the FLUOROLOG®'s exclusive strong stray-light rejection, and ability to detect IR fluorescence.

The FLUOROLOG®-Tau accessory provides an additional dimension of discrimination. With these data, new dental treatments and products may be assessed. Further work may lead to a quick, convenient method of tracing decay.

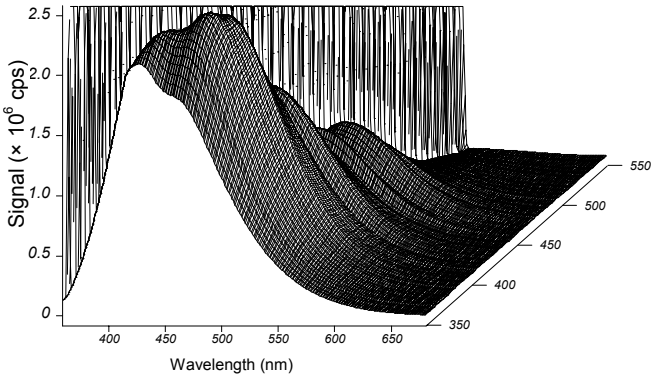

Figure 1. Clean enamel area of tooth

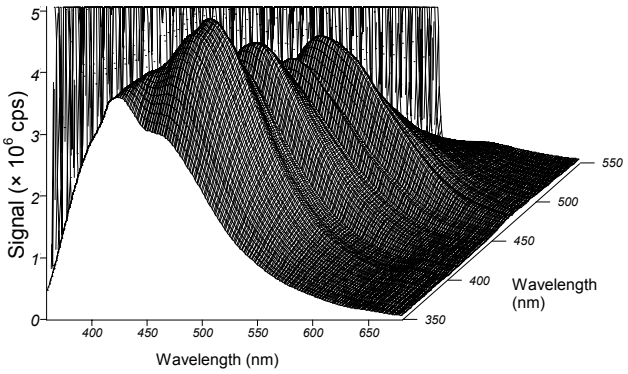

Figure 2. Heavy decay area on tooth.

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