0697 Laser Photothermal Radiometry for the Detection of Early Enamel Demineralization

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Background: Recently, a new methodology using Photothermal Radiometric (PTR) signals has emerged in an attempt to create a sensitive diagnostic tool for the early detection of incipient dental caries. **Objectives:** The purpose of the study was to characterize PTR phase and PTR amplitude signals of controlled mineral loss from human enamel to mimic surface and subsurface dental caries. **Methods:** 1mm^2 area on a flat surface of extracted unerupted healthy third molars was etched sequentially with 37% phosphoric acid for 20s, 40s and 60s and scanned following each etching, using a semiconductor laser at 30Hz. The virgin tooth surface prior to etching served as a control. In another set of experiments, subsurface demineralization was produced using a demineralization solution. Radiographs of the area were taken everyday until signs of a subsurface dental caries was noticeable on the film. PTR scanning was performed at 1, 3, 10, and 30-day intervals. Atomic Force Microscopy as well as SEM were used to assess the mineral loss from each artificial lesion. Five replicates were used in each experiment. Repeated measures ANOVA were used to compare PTR signals among different degrees of demineralization. **Results:** The scans of the sequential etchings showed a linear tendency for the PTR phase to decrease with increasing etching times. While subsurface lesions were detectable by PTR amplitude after 24h, it took 10 days for the lesions to be apparent on standard radiographs. There was a similar progressive trend in PTR amplitude with increasing degree of demineralization. **Conclusion:** These experiments provide sets of standardized PTR signals, which can be directly related to different degrees of demineralization. They also provide the bases for the early detection of dental caries using laser photothermal radiometry.

Seq #97 - Caries Detection and Dental Diagnostics
2:00 PM-4:00 PM, Thursday, 10 March 2005 Baltimore Convention Center Exhibit Hall E-F

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