238 Detection and monitoring of dental erosion using PTR-LUM

Thursday, March 17, 2011: 8 a.m. - 9:30 a.m.
Location: Room 30AB (San Diego Convention Center)
Presentation Type: Oral Session

*S.H. ABRAMS[1], **A. MATVIENKO**[1], V. YE[2], A. MANDELIS[2], K. RAMALINGAM[3], and B.T. AMAECHI[3], [1]Quantum Dental Technologies Inc, Toronto, ON, Canada, [2]University of Toronto, Center for Advanced Diffusion-Wave Technologies, Toronto, ON, Canada, [3]Department of Comprehensive Dentistry, University of Texas - San Antonio / Health Science Ctr, San Antonio, TX*

Objectives: The purpose of this *in vitro* study was to evaluate the potential of infrared photothermal radiometry and modulated luminescence (PTR-LUM), the technology behind The Canary System, to detect erosion lesions and their remineralization on human tooth enamel.

Methods: Five extracted caries-free human molars were collected and individually fixed on LEGO® bricks to facilitate scanning. The experimental setup consisted of a semiconductor laser (659 nm, 120 mW), infrared detector for PTR, photodiode for LUM, two lock-in amplifiers, and computer for data processing. Each sample was painted with acid-resistant nail-varnish, except a (1x4)-mm window for the treatment. Smooth-surface erosion lesions were created on the exposed window using freshly squeezed orange juice (pH 4.0). PTR-LUM frequency scans were performed before and after immersion in orange juice for 24 hours. Following erosion treatments, lesions were exposed to an artificial remineralizing solution for 7 days (2.2 mM potassium phosphate (KH_2PO_4), 2.2 mM 1M calcium chloride ($CaCl_2$), 0.05 ppm fluoride (F-), potassium hydroxide (KOH) for balancing the pH at 7.2) and scanned again with PTR-LUM. This was followed by the validation of the presence and nature of lesion using transverse microradiography (TMR).

Results: PTR-LUM signals (amplitude and phase) showed consistent changes following the initial erosive challenge and its subsequent remineralization. The decrease in the PTR amplitude and phase signals was consistent with the onset of surface mineral loss after erosion which reversed after the treatment with the remineralizing solution. LUM signals exhibited high sensitivity, however, less contrast than PTR due to baseline shifts. Surface wear of erosion lesions was identified with TMR. Mineral loss and lesion depth parameters validated lesion presence.

Conclusion: This proof-of-concept study demonstrated the capability of PTR-LUM to detect and monitor the progression and remineralization of early erosion lesions on enamel.

Keywords: Cariology, Diagnosis, Erosion, Fluoride and Saliva
Presenting author's disclosure statement: The presenter is a current employee of Quantum Dental Technologies' (QDT) R&D team. QDT is the developer of PTR-LUM technology and The Canary System.