

Wednesday, March 16, 2011: 3:15 p.m. - 4:45 p.m.

Location: Room 30A (San Diego Convention Center)

Presentation Type: Oral Session

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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 monitor demineralization and remineralization of human enamel and root conducted in an Artificial mouth environment.

Methods: Twenty caries-free extracted human teeth were collected, sectioned mesiodistally into two parts, and divided into 10 groups of 4 half-teeth each. Each sample was mounted on LEGO® bricks to facilitate scanning. Demineralization was produced by subjecting the samples to a mixed *Streptococcus mutans* and *Lactobacilli casei* continuous flow biofilm model acting as Artificial mouth, where the streamline flow of simulated oral fluid (SOF), Todd Hewitt broth, allowed for plaque growth and subsequent caries development. During remineralization, the SOF was sterile modified artificial saliva containing: CaCl₂, KH₂PO₄, KCl, NaN₃, fluoride, methyl-p-hydroxybenzoate, and sodium carboxymethylcellulose. The pH was adjusted to 7.2 using KOH. Each group of 4 teeth was scanned with the PTR-LUM before the demineralization, after 1, 3, 7, 10, 14 days of demineralization, and after 10, 20, 30, 40, and 50 days of remineralization. The PTR-LUM 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. Following each step of treatment, lesions were validated with transverse microradiography (TMR).

Results: PTR-LUM signals showed gradual changes with treatment time. The PTR amplitude and phase continuously increased with demineralization and then continuously decreased with the remineralization treatment. The LUM signals exhibited similar behavior during remineralization, albeit with less contrast than PTR.

Conclusion: This study demonstrated the ability of PTR-LUM in detecting and monitoring lesions on enamel and root surfaces produced in an Artificial mouth system, under simulated conditions more reflective of the natural oral environment.

Keywords: Caries, Cariology, Demineralization/Remineralization, Plaque and Preventive dentistry

Presenting author's disclosure statement: The presenter is currently employed by Quantum Dental Technologies Inc., the developer of PTR-LUM (The Canary) technology.