Using PTR-LUM ("The Canary System") for in-vivo detection of dental caries: clinical trial results

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Objective: Using Frequency Domain Photothermal Radiometry (PTR) and Modulated Luminescence (LUM) diagnostics, Quantum Dental Technologies, Inc., (QDT) has developed and tested a portable PTR-LUM instrument (The Canary™ Dental Caries Detection System) detecting artificial dental caries in several in-vitro studies. The aim of the present clinical trial was to determine the safety and in-vivo application of this device for clinical detection of early caries. Methods: In this study, PTR, LUM amplitude (A) and phase (P) responses at various modulation frequencies from healthy and carious dental enamel (ICDAS 0-6) were measured. A clinical trial was done using The Canary™ (prototype 1), under the approval of Health Canada. Over 500 regions on healthy tooth surfaces of 50 subjects were used to construct a healthy baseline for each output channel (1-PTR-A, 2-PTR-P, 3-LUM-A and 4-LUM- P). While PTR-A and PTR-P were used to detect near-surface and subsurface lesions, LUM-A and LUM-P were used to detect near-surface lesions. Results: The Canary™ did not cause any adverse events or soft or hard tissue trauma. There was no difference in signal from wet or dry tooth surfaces; anterior and posterior healthy tooth surfaces provided the same signal, and the presence of surface stain and biofilm did not affect the signal from healthy tooth surfaces. In carious enamel, we observed a clear shift from the baseline in both PTR (PTR-A- increased up to 6%-230%, PTR-P shifted up to 5%-25%) and LUM (LUM-A decreased up to 7%-85%, LUM-P shifted up to 1%-9%) depending upon the type, depth and nature of the lesion. Conclusion: Results from this first clinical trial showed that the Canary™ is safe, discriminates healthy and carious enamel.
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