Integrating 21st Century Caries Detection into your Clinical Practice

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Is a general dental practitioner with over 30 years of clinical experience. In 1999, Dr. Abrams began working on a non-invasive laser-based device for the diction and monitoring of caries. He currently jointly holds patents on this new technology. In 2006, he founded Quantum Dental Technologies to finish development of The Canary System. The Canary System, based upon the PTR-LUM technology is currently available in Canada and Europe.

Dental caries is one of the major diseases that we treat in our clinical practices on a daily basis. It is one of the two major diseases that is the focus of our preventive appointments and our patients do expect an update on the health of their "teeth and gums" at each visit. But techniques for caries detection have not changed radically over the last 60 years, since the advent of X-ray imaging. Detection of caries depended upon locating mineral loss on bite wing radiographs, examining stain and discoloured areas on the tooth surface or probing lesions with a sharp explorer. These techniques were and still are considered the gold standards even as the treatment of the disease has evolved.

Radiographs and visual examination do have many limitations. Detecting early pit and fissure caries is challenging. Radiographic imaging is of minimal diagnostic value because of the large amounts of surrounding enamel.[1,2] Studies[3-5] have suggested that dental X-Rays have little value in the detection of occlusal surface caries, and that dental explorers are inefficient for the diagnosis of occlusal caries.[6,7] Radiographs do perform well in detecting carious lesions in interproximal areas, especially if the area of decay is at least halfway through the enamel or into dentin. But in terms of early lesion detection, radiographs are not able to detect small lesions in the order of 50-500 µ (microns) in the interproximal areas, which could remineralize or re-crystallize if detected early and suitable preventive measures instituted.[8] An extensive review of the literature by Doveix found that "overall the strength of the evidence for radiographic methods for the detection of dental caries is poor for all types of lesions on proximal and occlusal surfaces." He further stated that "it is beneficial only if the intervention is the surgical removal of tooth structure and detrimental if it is used for non-invasive remineralization methods". Radiographs and visual examination are valid diagnostic tools for the detection of larger lesions; however, there is a need for more sensitive methods especially if one wants to practice minimal intervention dentistry or to attempt remineralization of carious lesions.

A common clinical situation is the detection and ongoing monitoring of a white spot lesion. In the example in Figure 1, this lesion appears to have an intact surface. With polarized light microscopy (PLM) the lesion is at least 500 microns in depth and located just below the surface. This lesion is not visible on radiograph or picked up by DIAGNOdent™. So, how do you detect this lesion? How do you monitor this lesion and how do you engage your patient to take care of this lesion and others that may be present?

One approach is to employ detection methods that allow the oral health provider to measure changes in the crystal structure of these early lesions and then tailor a therapy regimen to the lesion size as well as the overall risk of developing additional carious lesions. The Canary System directly assesses the status of the enamel crystal by using PTR-LUM — an energy conversion technology. Pulses of laser light are shone on the tooth and the laser light is converted to heat (Photothermal Radiometry or PTR) and light (luminescence or LUM) which are emitted from the tooth surface when the laser is off. The Canary System is the only device that is able to detect changes in the crystal structure of enamel, which is far superior in assisting the dental professional in diagnos-