Detecting dental caries: Is there anything new?

An overview of the latest technologies and their clinical potential

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Dental caries is still one of the most prevalent but preventable diseases in the world. There is increasing evidence that those with poor oral health have poorer general health outcomes as well. Whether this is a causative relationship or an association with other factors is yet to be determined.

Even though a large proportion of the population in developed countries have seen improvement in their oral health over the past three or four decades, individuals from certain groups, such as lower socio-economic groups and the medically compromised, are still at high risk of developing dental caries. There has been a change in the philosophy around what is considered appropriate treatment, with a move away from the surgical model to a disease management model, often termed minimum intervention dentistry. As a result of the decline in caries experience, the sensitivity of caries diagnosis has been reduced. Early diagnosis is vital, as it allows intervention to prevent the disease when it is present, and the results should be seen in conjunction with other detection methods, not as a stand-alone gold standard.

Recently developed quantitative light-induced fluorescence systems (including OLF, Inspector Research Systems, and SOPROLIFE, Acteon) utilise differences in auto-fluorescence between sound and demineralised enamel and dentine (Fig. 3). Demineralised enamel appears darker than the adjacent sound enamel, while the carious dentine fluoresces red depending on the filter used. The use of OLF (wavelength 405 nm) enables the early detection of enamel demineralisation, and it can be used to discriminate between affected and infected dentine. Like DIAGNOdent, OLF technology is based on the principle that sound tooth structure has a higher index of light transmission than a carious tooth does. Units such as the SDI diagnostic tip for SDI’s light curing unit or the NSK transillumination handpiece are simple to use. The light source is placed on the buccal or lingual side of the tooth as in Figure 5 illustrating the head of the SDI unit. Transillumination is primarily used for the detection of proximal carious lesions, although studies have indicated it can also improve visual detection of occlusal lesions. Carious lesions limited to the enamel appear as grey shadows, and those in the dentine appear as orange-brown or bluish shadows.

The use of digital radiography has become commonplace among many practitioners. The detection capabilities of digital radiography are reported to be similar to that of film-based methods, and have the benefit of reduced radiation exposure and the ability to readily transfer the images.

The recent development of multi-tone discing gels (TriPlaque ID Gel, GC Corporation) may aid caries detection, as old and cariesogenic plaque can be identified relatively easily—and white spots tend to occur under older plaque, so this can target the areas to be investigated after gel removal. These products are potentially good for patient education, as the area of risk can be easily pointed out to the patient.

Obtaining diagnostic reproducibility between examiners is difficult, as clinicians tend to develop individual concepts based on experience regarding caries detection and the subsequent preventive or restorative treatment options. Length of experience also contributes, with experienced examiners having higher sensitivity, higher specificity and greater reproducibility than those less experienced. Owing to the lack of a single detection method that provides both high sensitivity and high specificity, combining a number of methods is recommended to increase the accuracy of detection. For example, this may mean combining DIAGNOdent or SOPROLIFE findings with direct visual and radiographic images. Several factors, such as fluorescent lighting, can upset the results of fluorescent-based detection methods, so care in control of ambient lighting and standardisation of methodology are imperative when using these new detection methods.

The development of new technologies to assist in the detection and diagnosis of caries can provide increased reliability, however, they must be used in the context of traditional visual and radiographic assessment still being the gold standards of care at present. The current development of ICDAS by a worldwide group of cariologists will use ICDAS and the current evidence base to provide information that will allow clinicians to use information such as lesion characterisation and caries risk to formulate valid treatment decisions.

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A list of references is available from the publisher.