Advances in Pediatric Dentistry

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KEYWORDS

• Caries detection diagnostic imaging tools • Early interventions
• Primary prevention • Caries-risk assessments
• Dental materials • Pediatric procedures

The use of new technology is shifting the practice of dentistry. New imaging devices, restorative procedures, and the application of the Internet and powerful electronic devices are examples of advances that have made a foremost impact on dentistry. Even though pediatric dentists may not have as many new tools of treatments compared with dentistry colleagues, their practices have nonetheless been improved significantly in recent years by advancements. Newer-generation imaging devices have allowed us to view details of the dental anatomy that heretofore were not visible to us before. This article summarizes the current state of pediatric dentistry.

CARIES DETECTION DIAGNOSTIC/IMAGING TOOLS

Early detection is crucial in the management of dental caries. When detected at an early stage at which the enamel surface has not collapsed, the incipient lesion can be treated with preventative therapies that can retard and eventually arrest the progression of early lesions and preserve the enamel tooth structure, function, and aesthetics.

Traditionally, a subjective method of visual inspection has been used as the most ubiquitous caries detection method. Key features, such as color and texture, are assessed. The assessment indicates some information on the severity of the caries process but falls short of true quantification. In addition to its limited detection threshold, the ability of this assessment to detect early, noncavitated lesions is poor.[1]

To meet the challenges in dentistry, there is a tremendous need for a range of caries detection and quantification systems to augment the practitioner's diagnostic pathway.[2] A range of relatively new detection systems, including diagnodent laser device (KaVo, Biberach, Germany), digital imaging fiber-optic transillumination (DIFOTI, KaVo Dental, Lake Zurich, IL, USA), and quantitative light-induced fluorescence (QLF, QLF-clin, Inspektor Research Systems BV, Amsterdam, Netherlands),

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Dent Clin N Am 55 (2011) 419–432
doi:10.1016/j.cden.2011.02.004 **dental.theclinics.com**
0011-8532/11/$ – see front matter

are considered as possible supplemental techniques for detecting incipient carious lesions.

Diagnodent Laser Device

Many studies have demonstrated that the diagnodent device is a valuable addition to the clinical examination and appropriate also for longitudinal monitoring of the occlusal and smooth surface caries process because of its objective readings.[3–5]

The device emits fluorescence after application of pulsed red light with a wavelength of 655 nm, and the fluorescence emitted from the tooth is translated into a numerical scale from 0 to 99.[6] When irradiated by light of a given wavelength, the tooth surface fluoresces.[7] The laser light is absorbed by organic and inorganic substances present in the dental tissues and also by metabolites from oral bacteria. It is these metabolites that result in the red fluorescence of carious dentin.[8] There is a baseline fluorescence level for sound enamel and a different fluorescence level after the caries process has initiated. It has been shown that deeper and hence more demineralized lesions have a higher fluorescence reading at the surface of the tooth. Nonetheless, whether this increased reading corresponds to an increased bacterial load within the lesion has yet to be demonstrated.[3]

DIFOTI

Different diagnostic tools, including digital bitewing radiographs, fiber-optic transillumination (FOTI), and DIFOTI, are used for a more accurate and reliable diagnosis for interproximal carious lesions. The basic principle behind transillumination is that demineralized areas of enamel or dentin scatter light more than sound areas of enamel and dentin.[9]

The system of FOTI is made of a high intensity light and a gray scale camera that can be fitted with 1 of 2 heads; one for smooth surfaces and one for occlusal surfaces. Images can then be displayed on a computer monitor and be archived for later examination. However, quantification of the images is not possible, and hence the analysis is to be undertaken in conjunction with a visual examination by the clinician who has to decide subjectively based on the appearance of scattering. Because there are no continuous data outputted, longitudinal monitoring is not possible. Therefore, some degree of training is recommended to be competent at this level of FOTI use.[10]

Digital imaging is a more recent development combining FOTI with a charge-coupled digital intraoral camera.[10] This technology involves light, a charge-coupled device camera, and a computer-controlled image acquisition. Digital imaging's advantages over traditional radiography include the absence of ionizing radiation, the lack of a need for film, real-time diagnosis, and higher sensitivity in detection of early lesions that are not apparent in radiography.[10]

QLF

QLF is a visible light system that offers an opportunity for early detection of caries and also its longitudinal monitoring. With 2 forms of fluorescent detection, green and red, QLF can determine if a lesion is active or not and can document the progression of any given lesion. Here, the visible light has a wavelength of 370 nm, which is in the blue region of the spectrum. The resultant autofluorescence of human enamel is then detected by filtering out the excitation light using a bandpass filter at a wavelength greater than 540 nm via a small intraoral camera, which produces an image of only green and red channels because blue light has been filtered out. The color of the enamel is green and the demineralization of enamel results in a reduction of this autofluorescence. The loss can then be quantified with proprietary software.[11,12]