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Past Issue

Caries Detection Devices

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Caries management by risk assessment includes detecting caries lesions at the earliest clinical stage possible (ideally before cavitation) to stop or reverse the caries process with remineralization and biofilm modification and use of minimally invasive, tooth preserving restorative techniques if cavitation should occur.

For more than a century, clinicians have relied on their vision, dental instruments, and radiography as diagnostic tools. The American Dental Association's Archives in Chicago includes one of the first "caries detection" devices—Cameron's Dental Diagnostic Lamp manufactured in the 1920's by Cameron Surgical Specialty Co., of Chicago. The device used a narrow cool white lamp that could be placed in the mouth behind teeth. The manufacturer's booklet, "Diagnosis by Transillumination," (1924), claims the product "is efficient in furnishing cool light for examining the teeth, and locating deposits and hidden cavities."

Transillumination is simply the shining of a light through a body area or organ to check for abnormalities.[1] It is still in use today in dentistry and medicine, although the technologies have greatly changed. Some caries detection devices feature lasers that cause fluorescence of the tooth while others use transillumination to see through enamel.

According to the U.S. Food and Drug Administration, which regulates these products as Class II Medical Devices, "The caries detection device is a device intended to show the existence of decay in a patient's tooth by use of electrical current"[2] and "A laser fluorescence caries detection device is a laser, a fluorescence detector housed in a dental handpiece, and a control console that performs device calibration, as well as variable tone emitting and fluorescence measurement functions. The intended use of the device is to aid in the detection of tooth decay by measuring increased laser-induced fluorescence."[3]

Since the ADA Professional Product Review first published "Adjunctive Detection Devices for Carious Lesions" in 2008 (Volume 3, Issue 3), some products were discontinued and others entered the market. This article is intended to provide a snapshot of some of the devices currently available in the United States that focus

on detecting caries lesions before they are detected clinically with the naked eye or on radiographs. All of these products should be considered as adjuncts to a clinical/radiographic exam and caries risk assessment.

Before You Buy

If you are thinking about adding any of these devices/techniques to your practice, keep in mind that they should be considered as adjuncts to a clinical/radiographic exam and caries risk assessment. Here are some key considerations and concerns:

The imprecise use of marketing terminology may lead to overtreatment. For example, some marketing literature states that these new devices will identify “caries” before they are clinically or radiographically visible. Historically, the term “caries” was synonymous with “cavity” and triggered a surgical restorative response. The clinician should remember the differences between “caries the disease” and “caries the lesion.” Detection techniques and tools detect lesions. The devices are not a replacement for a comprehensive clinical assessment of caries the disease and the risk factors that cause it. Furthermore, the level of detection offered by these devices does not necessarily correspond to surgical intervention.

Table 1. Caries Detection Devices

FDA Classification	Device Name	Features/Claims*	Buying Considerations†
Caries Detector, Laser Light, Transmission	MicroLux Transilluminator AdDent, Inc (203) 778-0200	Fiber-optic transillumination of LED light Autoclavable 2mm and 3mm light guide. Battery operated Portable Protective sleeve available	Does not measure lesion depth or surface cavitation. Interpretation is by direct visualization
Caries Detector, Laser Light, Transmission	DEXIS CariVu Dexis (888) 683-3947	Uses near-infrared light Transillumination makes the enamel appear transparent while porous lesions trap and absorb the light. Lesions appear as dark areas Allows clinician to see through the tooth exposing its structure and the actual structure of any caries lesions	Not quantitative Measures surface scattering of a lesion; not depth. Software makes the lesion look dark (like a radiograph). Could mislead clinician to think the device is measuring lesion depth or cavitation Do not read it as you would a radiograph
Caries Detector, Laser Light, Transmission	KaVo DIAGNOdent KaVo Dental (888) 275-5286	Integrated loudspeaker with intensity control emits audible tone Battery operated Sapphire tips Storage/sterilization cassette with 4 occlusal tips Unit display shows maximum (peak) and current (moment) readings Detachable/sterilizable grip sleeve and tips	Needs clean dry surfaces. Gives numeric indicator; numbers above 30 indicate a problem; does not exactly indicate where or how deep Higher sensitivity (i.e., correct detection of disease) but lower specificity (i.e., correct detection of sound sites) than visual assessment methods. Thus, because of potential false-positives (i.e. sound sites incorrectly diagnosed as carious), its use should be limited to supplementing the clinician's primary diagnostic method Does not measure lesion depth or surface cavitation
Ultraviolet Detector	DOE SL DenLight (800) 763-6803	Multi-wavelength LED illumination Easy to document cases with office camera Cordless	Does not directly measure lesion depth or surface cavitation (other than what is directly visible on the captured image)
Laser, Fluorescence Caries Detection	SoproLIFE Acteon North America (800) 289-6367	Detects occlusal or interproximal decay Diagnosis aid Mode: Provides characterization of lesions at different clinical stages. Image magnification of 30x-115x Treatment Aid Mode: Images show a differentiation of pre-operative healthy tissue versus diseased tissue Daylight Mode: Device can be used as a white light intra-oral camera	Does not directly measure lesion depth or surface cavitation (other than what is directly visible on the captured image)
Laser, Fluorescence Caries Detection	Cam-X Spectra Air Techniques, Inc (516) 433-7676	Carious regions appear red, while healthy enamel appears green Detects decay hidden between the margins of existing composite and amalgam restorations	Does not directly measure surface cavitation (other than what is directly visible on the captured image)
Laser, Fluorescence Caries Detection	The Canary System Quantum Dental Technologies (866) 993-9910 (press 3)	Detects caries under sealants and around the margins of restorations Detects caries on all tooth surfaces, as small as 50 microns up to 5 mm below the surface Not affected by stain or calculus Does not require isolation or dry field	Can measure depth of demineralization up to 5 mm Screening tool gives numeric indicator; numbers above 20 indicate a problem, but it does not tell exactly where or how deep. Should be used to supplement and not be relied on as a clinician's primary diagnostic method

* Features compiled from manufacturers' literature and websites.
† Authors' comments.

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There are many clinical tools to detect and classify the caries lesion, including the new American Dental Association’s Caries Classification System[4] (ADA CCS), the Caries Assessment Spectrum and Treatment[5] (CAST) index, the International Caries Detection and Assessment System[6] (ICDAS) and its latest iteration — the

International Caries Classification and Management System[7] (ICCMS). All of these classification systems consider early non-cavitated lesions as well as cavitated lesions in their schemes.

Most of the early detection devices use technologies that contrast areas of mineral loss or demineralization to healthy tooth structure. Changes in mineral density will scatter light, heat, or transmit electrical stimulus differently when compared to healthy hard tissues. These technologies do not necessarily tell the clinician if the surface is cavitated, which is the driving force to decide if the tooth needs to be surgically restored. Bacteria, which are too large to enter enamel diffusion channels, cannot penetrate intact surface enamel and enter the dentin unless the surface is significantly cavitated.

Non-cavitated lesions should be treated in a comprehensive way including the use of products that promote remineralization and the appropriate management of the plaque or biofilm over the lesion (not all plaque is pathogenic). Non-cavitated lesions in the pit and fissures should be appropriately sealed on patients at risk for caries disease. All these interventions should be monitored and repeated as needed as part of a comprehensive treatment approach to caries disease, which should include the assessment and modification of risk factors at the personal, familial and community levels at each visit.

Many companies advertise these detection devices as “practice builders,” which may be perceived as suggesting that early detection will lead to more restorations. Since non-cavitated carious lesions can often be successfully managed and reversed with remineralization techniques, these early detection devices should be viewed as tools to manage disease rather than to initiate early surgical care.

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