

CLINICAL 360° TECHNOLOGY

THE TAKE-AWAYS

- There are better ways of diagnosing caries than the traditional explorer or radiography.
- Enhanced imaging caries detection technologies can diagnose and help properly treat caries.

Caries detection—the times they are a-changin’

Diagnostic technologies have changed the way clinicians should approach their caries detection protocol.

by DR. MARTY JABLOW, GUEST CONTRIBUTOR

THE TEAM

Bringing together a variety of voices for the best advice and big ideas.

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THE SET-UP

"We are all looking for better ways to help our patients, and what better way than detecting and monitoring caries at its earliest stages. Several devices give dentists the opportunity to do just that. They not only allow dentists to see caries that might otherwise be impossible to detect, they provide valuable info to help guide treatment. So see what my buddy Dr. Marty Jablow has to say and see if one of these technologies is right for you."—**DR. JOHN FLUCKE, TEAM LEAD**

THE more things change the more they remain the same¹ is an epigram from the mid-1800s. This is the same time period that G.V. Black was forming the backbone of modern dentistry.

Now more than 150 years later dentistry is still evolving, and yet dentists are still relying on the explorer as one of the primary tools in dental caries diagnosis.

"A sharp explorer should be used with some pressure, and if a very slight pull is required to remove it, the pit should be marked for restoration even if there are no signs of decay."²

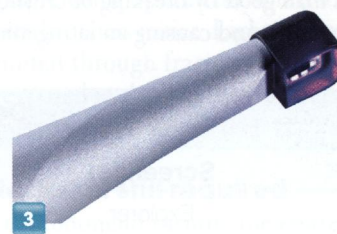
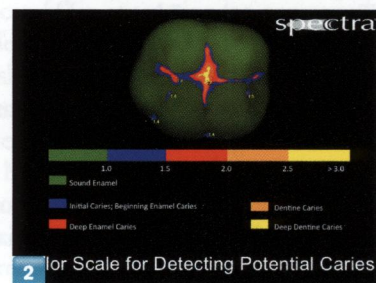
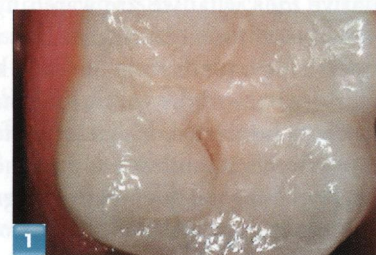
This was Dr. Black's state-of-the-art caries detection in the early 1900s. So, although dental technology and knowledge are continuing to evolve, we are still relying on Dr. Black's philosophy of using an explorer as a primary method to detect dental caries today.

Waiting and watching

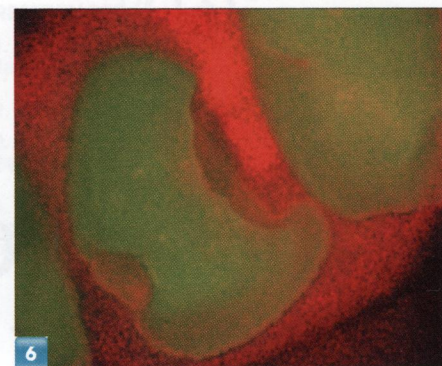
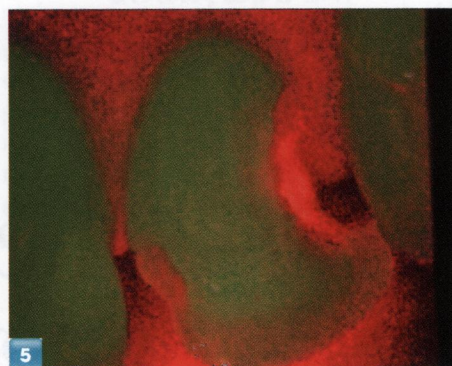
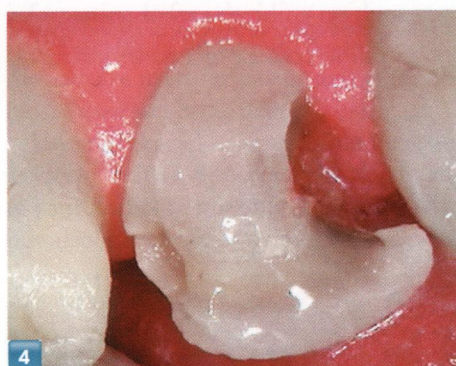
With the increased use of fluoride, improved nutrition and better prevention, dental caries has become more difficult to detect. Even with the use of digital radiography, decay is difficult to detect in radiographs unless larger than 2 mm to 3 mm deep into dentin, or one-third the bucco-lingual distance.³

An explorer has high specificity for caries but low sensitivity for the caries. This means a lot of incipient caries can be missed

AT A GLANCE



FIGS. 1-3 An intraoral camera provides the magnification for viewing grooves and other details (Fig. 1). Spectra provides numerical and graphical information superimposed on the image of the tooth (Fig. 2). Spectra's camera head features six LEDs (Fig. 3).



FIGS. 4-6 Spectra works like digital caries detection dye, helping clinicians visualize the difference between carious dentin and healthy tooth structure.

if we rely on an explorer and radiographs alone. In many cases these are the teeth dentists are “Watching.”

The question is just what are we watching? In most cases dentists have no quantitative idea what we are watching and limited tools for measuring it. This is just supervising a tooth without really knowing the extent of the carious lesion or if the decay is arrested. It's just a gut feeling as to whether a tooth needs treatment or not. Without good quantitative diagnostic information, how are we to choose from the increasing amount of treatment choices (see “Treatment options,” last page)?

Explorers fade from favor

For almost two decades the literature has been recommending discontinuing the use of the dental explorer for caries detection.⁴ Some dental schools now teach reduced reliance on the explorer for caries detection especially for pediatric patients.

An explorer may actually cause more harm than good by breaking or crushing the enamel rods and causing an iatrogenic cavi-

tation when forced into an incipient carious lesion. This disruption of the enamel matrix may actually further the caries process by disrupting the enamel barrier and allowing for greater infiltration of bacteria into the incipient carious dentin below. The problem is detecting the initial stage of caries. At these early stages of caries, remineralization should be considered as a viable treatment option, but monitoring the effectiveness of the remineralization process may be a problem.

Spotting the problem

The recommendation of all of these “no explorer studies” is to use visual detection of caries instead of the explorer stick. So the basic recommendation is surgical loupes with a minimum of 2.5X magnification along with proper illumination. This allows you to peer into the grooves to assist in diagnosing caries.

In my opinion this is the perfect job for an intraoral camera. The camera has the ability to visualize grooves with proper illumination and magnification simply and easily (Fig. 1).

This is the initial step in caries detection. Then we need to assess which teeth need further diagnostic information to determine the precise form of treatment. In the past this is where the proverbial diagnostic fork in the road occurred and the dentist then determined if he would watch the tooth or restore it.

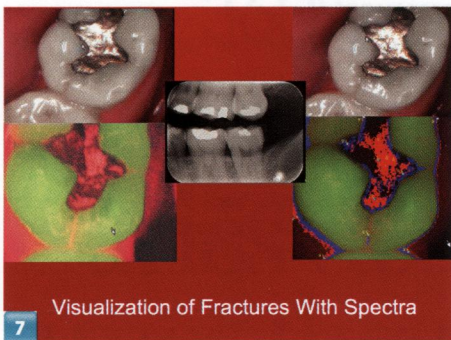
Advanced diagnostics

Now there are enhanced diagnostic devices to assist in making a more accurate caries diagnosis. Enhanced caries detection devices are another tool aiding in the diagnosis of caries along with the conventional diagnostic tools and good professional judgment. It's extremely important for the dentist to become familiar with the benefits and limitations of these enhanced caries detection devices.

We must divide these caries detection devices into two groups—screening devices and imaging devices (see “Detection devices,” below).

Screening devices allow us to determine if there is caries in a tooth. They may not be able to give the direct location of all caries and the nature and depth of the caries in an individual tooth. Screening devices such as KaVo's DIAGNOdent (kavousa.com) and CarieScan's CarieScan PRO (cariescan.com) assess the tooth and give a numerical score while an explorer or DENTSPLY Professional's Midwest Caries I.D. (cariesid.com) provide a yes or no response. The dentist then must interpolate this information. The information helps the dentist diagnose the presence of caries and

Detection devices	
Screening	Imaging
Explorer	Radiographs
DIAGNOdent	Transillumination
Midwest Caries I.D.	Intraoral Camera
CarieScan PRO	Spectra
	SOPROLIFE



FIGS. 7 Spectra also can aid in identifying fractures.

gives some idea of depth and location of the caries.

Imaging devices allow for visualization of a carious lesion. Radiographs have been the gold standard for diagnosing interproximal decay and the size of a carious lesion. Using magnified loupes or an intraoral camera to visualize the occlusal grooves to look for staining or cavitation gives some indication of the caries process. Saving an intraoral image can assist when monitoring an incipient carious lesion. However, transillumination of interproximal or occlusal caries may be difficult on posterior teeth or around existing restorations.

The cutting edge

Even more enhanced information can be gleaned through the use of Air Techniques' Spectra (airtechniques.com) or Acteon's SOPROLIFE (acteongroup.com). These enhanced imaging caries detection devices can aid in determining incipient caries, the depth and location of the caries and locating caries around existing restorations. They also provide the ability to save the images for both monitoring and medical legal purposes.

Spectra also has the ability to analyze the lesion and produce numerical graphing superimposed onto the tooth image to further assist in the caries detection process (Fig. 2). These analyzed images enhance your ability to communicate the nature and degree of caries in a highly visualized manner to the patient. Just explain to the patient what the colors mean. The easy-to-read colored overlays makes the patient education

process very easy because the patient can read the images along with you.

Detection science

All of these enhanced caries detection devices work through a process of measuring fluorescence except for CarieScan, which uses AC impedance, and Midwest's Caries I.D., which uses light refractance. These fluorescence-based devices use a light source—either laser or LED—at a specific wavelength and then measure the fluorescence of the bacterial porphyrins associated with the bacteria that cause caries.

When the light stimulates the porphyrins in areas that have high numbers of caries producing bacteria, the light molecules are absorbed and some of the light energy is reflected back at a different wavelength. The fluorescence at this altered wavelength is then measured, and the result allows us to differentiate between healthy and unhealthy tooth structure.

Spectra is an intraoral camera dedicated to caries detection. It connects to a computer via USB and comes with its own software or can integrate with existing imaging software. This makes it very easy to move the device between operatories. It has a camera head and around the head are six light-emitting diodes producing a blue light at 405 nm (Fig. 3). When directed at the tooth, the blue light will cause the porphyrins from Strep Mutans to fluoresce red whereas healthy tooth emits an apple-green color. A barrier is placed over the camera for asepsis and a black hood is placed over the camera head to block ambient light and provide for the optical focal distance. This allows for consistent image reproduction, making it easier to monitor a tooth to determine if the caries is active or arrested.

Detection protocol

During the clinical examination using surgical loupes with illumination, the teeth suspected of having caries have the occlusal grooves cleaned of debris. Next an intraoral photograph is taken of the suspected tooth for further magnified viewing.

The tooth is then dried, and using the Spectra in diagnostic mode, the dentist

visualizes the red/orange fluorescence of the teeth when exposed to the blue LED, thus exposing the carious lesion(s).

After switching the Spectra into analysis mode, the software analyzes the image and the degree of fluorescence. The more porphyrins present the greater the fluorescence. The software interpolates the image and produces a weather radar style overlay indicating if a carious lesion is present, the location of the caries and the approximate depth of the lesion.

These images can be saved into the imaging software for future reference if monitoring the incipient lesion. They also can be used to help visualize the caries prior to restoring a tooth.

Beyond detection

Spectra also can assist in the caries removal process. Using Spectra in detection mode assists in identifying carious dentin. When using Spectra during the caries removal process, think of it as digital caries detection dye. By doing this, visualizing the difference between the remaining carious dentin and healthy tooth structure becomes much easier (Figs. 4, 5 & 6).

Be careful in excavating too aggressively. The dentin may become hard and still fluoresce slightly, so removal until just green fluorescence is visualized may not be necessary.

Fractured Tooth Syndrome can sometimes be extremely difficult to diagnose. In most cases the fracture is not easily visible to the naked eye. High magnification is required when attempting to view the fracture. The fracture may not be visible on a radiograph. Using Spectra the ability to view fractures becomes easier. Light will not be transmitted through fractured enamel. So when exposed to the light from Spectra the fracture is easily visualized (Fig. 7).

Clinical skill still required

I don't recommend turning the entire caries detection process over to technology. Good clinical judgment is absolutely necessary when diagnosing caries. All factors in the caries process such as the patient's age, diet and caries rate should be taken into account along with the diagnostic

information before deciding on the appropriate treatment for a tooth. No matter what devices are used for caries detection, the most important is the dentist's brain.

Using enhanced imaging caries detection devices such as Spectra will greatly add to your ability to not only diagnose caries, but also more efficiently remove the caries

and possibly visualize fractured teeth. All of these benefits allow you to better educate your patients, determine the appropriate treatment for a tooth and ease the restoration process, while giving your patients the confidence that you are giving them state-of-the-art diagnostics and treatment. ●

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TREATMENT OPTIONS

- Observe – The proverbial “watching a tooth”
- Sealant – Protecting the tooth from caries
- Remineralize – Attempting to reverse the caries process
- Preventative Resin Restoration (PRR) – Examine the grooves and treat accordingly
- Conventionally restore the tooth

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