

DEFINING DENTAL CARIES

Dental caries can be defined using two criteria. First, caries is a bacterial infection caused by specific acidogenic bacteria in the plaque biofilm. Second, caries is a multifactorial *process* of tooth demineralization and remineralization, which until cavitation is reversible. Caries is the point at which the process of bacterial demineralization of tooth structure overwhelms the patient's ability to remineralize tooth structure.⁹ This currently involves considerable professional judgment. Caries detection is an activity during which the clinician looks for objective findings on individual teeth using visual/tactile senses, possibly with assistance from technology. Caries assessment should be used to determine a current diagnosis and prognosis for the future.

A Reversible Multifactorial Process

Cavitation can be considered an event, the end-stage of a continuum. However, the caries process, which begins long before cavitation, is multifactorial, with contribution from bacteria, sugar (fermentable carbohydrates), saliva, and fluoride. Past dental and medical history also are factors to be considered.¹⁰ Since caries can be defined as a process, the key question becomes, is it reversible? Can caries heal? In the early stages, dental caries is reversible.¹¹ All dentists have seen initial white-spot lesions on teeth after orthodontic therapy that are solid one year later, as well as arrested lesions on proximal tooth surfaces following an extraction. How is this possible?

The development of dental caries is a dynamic process of demineralization of the dental hard tissues by the acidic byproducts of bacterial metabolism, alternating with periods of remineralization.¹² The bacteria in the plaque on the intact tooth surface metabolize the available sugar, with lactic acid as the most important acidic byproduct. Acid penetrates the solid yet microscopically permeable tooth surface, removing calcium and phosphate from the subsurface tissue, resulting in demineralization. The result is an initial white-spot lesion.

Remineralization can and does occur. Saliva can buffer the low pH in the plaque, and with the raised pH, calcium and phosphate are deposited, remineralizing the tooth. The key is the intact tooth surface. If it remains intact (noncavitated), remineralization is possible. After cavitation, remineralization is unlikely.¹³⁻¹⁶ The question for the clinician then becomes, is the lesion remineralizing, or is the caries process continuing? What is the *caries activity*?

An *active* lesion is progressing toward cavitation (demineralizing). An inactive lesion is not progressing or is healing (remineralizing). Therefore, determining the prognosis of the carious lesion before cavitation is the key. In the past, it was thought that the lesion was continuously progressing. We now know that the natural history of a carious lesion is characterized by periods of demineralization and remineralization. Subsurface demineralization eventually causes the collapse of the overlying tooth surface, creating cavitation. At this point, surgical intervention (restoration) must be used. Until then, medical intervention is possible.¹³⁻¹⁶

The status of any lesion is based on color, surface texture, and longitudinal radiographic findings. White-spot lesions may be



Figure 1. An example of an active lesion on the buccal aspect of tooth No. 22. This white, chalky surface is ideal for remineralization therapy.



Figure 2. Occlusal view of tooth No. 14 with white, chalky, active lesion in the distal pit and groove that is not yet cavitated.



Figure 3. This is an example of an inactive lesion. Note the dark, shiny, smooth, nonporous surface.

considered active if they appear chalky, nonglossy, and feel rough with an explorer. Inactive lesions have a relatively intact surface that is shiny and hard and feels smooth with an explorer. Inactive lesions may be stained a darker color¹⁷⁻¹⁹ (Figures 1 to 3). Longitudinal radiographs, instead of cross-sectional findings, aid in the assessment of lesion status. An explorer should be used only to evaluate white-spot lesions. A light touch should be employed with the explorer parallel to the surface of the tooth. Use of the explorer in a perpendicular direction with force could cause iatrogenic cavitation. Explorer use in occlusal grooves is contraindicated, as iatrogenic damage can be produced that will favor continued lesion development.²⁰ In the case of occlusal grooves, there is no diagnostic benefit from the visual plus tactile method versus the visual only method.²¹

New diagnostic devices are also available. Use of QLF, Inspektor Pro (OMNI Preventive Care), or DIAGNOdent (KaVo America) can be helpful. QLF utilizes the scattering properties of visible light to detect tooth/mineral irregularities. When the tooth is illuminated with the blue light, the light travels through the relatively transparent enamel with a low chance of absorption and a high probability of refraction. The light contacts intact enamel and dentin, causing a yellow/green fluorescence in random directions that is detected by the camera in the QLF handpiece. Early lesions appear as dark spots or shadows on the fluorescent image, while bacterial byproducts appear red on the screen.²²

DIAGNOdent employs laser technology to detect and quantify hidden or subsurface caries by measuring laser fluorescence within the tooth structure. Light is emitted from a solid-state laser with a wavelength of 655 nm. At this specific wavelength, clean, healthy tooth structure exhibits little or no fluorescence, resulting in very low readings on the display. Bacteria from the caries process produce porphyrins that fluoresce. Readings of 30 or more, along with visual evidence, are an indication of the need for surgical intervention.²³ Lower readings indicate the need for conservative treatment, with the caveat that remineralization is unpredictable on occlusal surfaces. Caution is urged when using these devices. Using a medical paradigm, surgical intervention is only indicated when there is cavitation. Devices with increased precavitation sensitivity might lead a dentist using the old surgical paradigm to early surgical intervention (restorations) where medical treatment (remineralization) is indicated.

While *caries activity* describes the status of the caries process as improving or worsening (remineralization or demineralization) for a tooth, *caries risk* is used to describe the patient. Caries risk can be defined as the likelihood that the patient will experience new cavitation. When educating patients, inform them that there are factors that increase risk and those that decrease risk. The factors that increase the likelihood of a future carious lesion are the presence and levels of specific bacteria and the level of fermentable carbohydrates (sugar). Bacteria are necessary to metabolize carbohydrate, but carbohydrate must be present. Not only are *Mutans streptococci* (MS) and *Lactobacilli* (LB) acidogenic (they produce acid), they are also aciduric, meaning they thrive in an acidic environment. Many other bacterial species cannot survive in an acidic environment. Therefore, the presence of elevated levels of sugar creates an environment in which MS and LB will thrive. Sugar consumption 2 or more times a day between meals places a person at high risk.²⁴

The factors that lower the risk for future carious lesions are normal salivary flow and high levels of fluoride. Stimulated salivary flow below 0.7 mL/minute is considered a risk factor for caries.²⁵ Other risk factors are past caries experience (decayed, missing, or filled [DMF] teeth or surfaces), lesion location, and medical history (diseases or medications that can lead to xerostomia, or medications containing high levels or concentrations of fermentable carbohydrates).