

Managing Caries in the 21st Century: Today's Terminology to Treat Yesterday's Disease

Douglas A. Young, DDS, MS, MBA

ABSTRACT

Background. For more than a century, dentistry has been treating the disease of dental caries largely by restoring teeth. Research in the microbiological and chemical mechanisms of the caries process over the past two decades suggests a fundamental rethinking of solely using this type of treatment approach.

Methods. A clinician's understanding of how the field has advanced has been impeded by the inconsistent use of dental terminology. This article will focus on defining dental caries and its related terms.

Conclusions. The term "caries," although used very liberally in the field, should be further defined in its context of use to avoid confusion, until which time an accepted international terminology system is developed.

Practice Implications. Reducing or eliminating ambiguity in terminology used in managing dental caries is the first step in consistent diagnosis, detection, and finally treatment.

Traditionally, dentists have spent the majority of their careers learning to repair damage to teeth caused by the results (or symptoms) of the disease of dental caries. Newbrun, in 1989, clearly defined caries as a bacterial disease; "Dental caries, or tooth decay, is a pathological process of localized destruction of tooth tissues by microorganisms."¹ In the new caries management paradigm, sometimes called caries management by risk assessment or CAMBRA, the medical-based model emphasizes that carious lesions are due to an infection by odontopathic bacteria.

Rather than solely treating symptoms by placing restorations, the focus becomes preventing and eliminating the bacterial infection, as well as other contributing pathogenic factors.²⁻⁵ In



Author / Douglas A. Young, DDS, MS, MBA, is an associate professor, Department of Restorative Dentistry, at the University of the Pacific, Arthur A. Dugoni School of Dentistry.

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the traditional model, the profession has focused on restoring teeth that have been damaged by results of an infection by certain cariogenic bacteria, predominately mutans streptococci and lactobacillus.^{6,7} However, a recent landmark randomized clinical caries trial has demonstrated that restoring teeth alone does not eliminate the causative bacterial infection or significantly lower the future decay rate of individuals.⁸

Yesterday's Terminology Leading to Confusion

When the single-term caries is used to describe a multitude of situations or findings, and treatment strategies are based on these findings, significant confusion could result in misdiagnosis and treatment.² Figure 1 illustrates how many different meanings the term caries could have. Depending on the context of the term, it could lead to dramatically different outcomes. For example, when referring to radiographs, radiolucent areas on bitewing radiographs often are simply called caries. Yet, from a clinical decision-making process, it is the presence of cavitation, as well as the activity of the lesion, that needs to be assessed. However, to help a clinician make a decision about when to surgically restore an approximal surface, the extent of radiographic penetration must be compared and validated to studies calibrating radiography to cavitation, not histology.^{9,10} The radiographic findings, as well as activity, should then be confirmed by clinical examination of the patient. In other words, simply calling something caries on a radiograph does not always make it so.

Brown stain is also erroneously called caries. Studies indicate that as the tooth becomes microscopically more porous during the demineralization, it can pick up exogenous stain, yet little to no bacteria may be present.¹¹ In fact, staining in dentin can happen in the absence of cavitation as small mol-

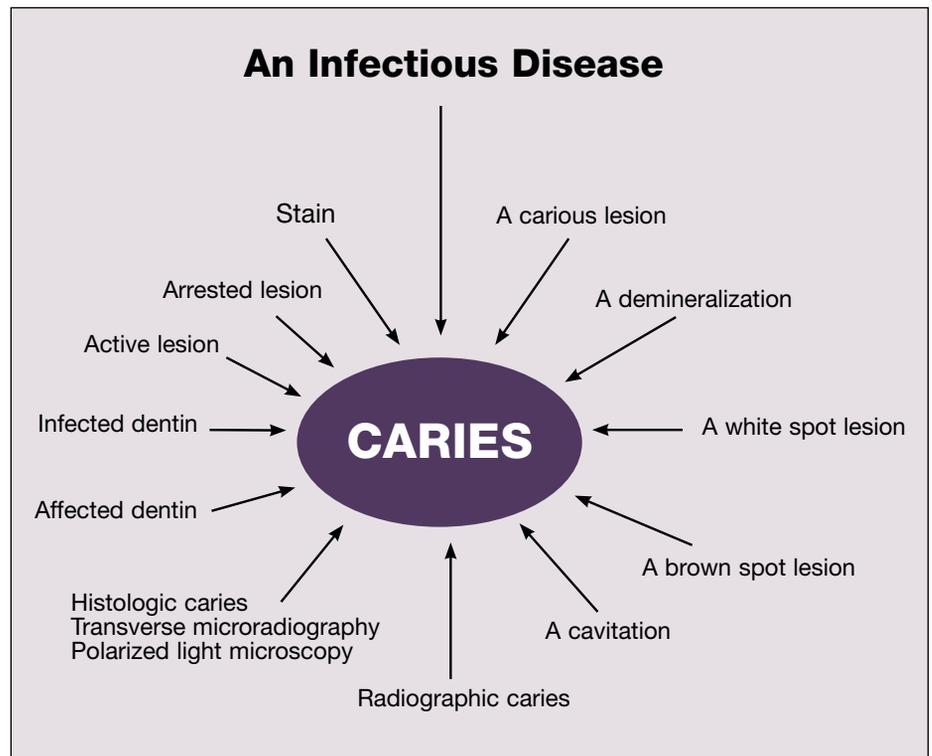


Figure 1. Defining caries. Caries is an infectious disease. All other terms describe the symptoms of the disease.

ecules can migrate into the diffusion channels of intact enamel, yet bacteria remains too large to fit into these small spaces. Similarly, the more porous areas tend to pick up caries detector dye on hard and stain-free dentin can result in unnecessary tissue removal.¹² Adding to the confusion, some state dental licensure boards define brown stain on the DEJ as caries, and if left, will most likely result in concluding that there was failure to remove caries. Yet, a similar stain on other parts of the tooth, such as the pulpal floor, could be considered affected dentin. Without microbiological studies, using stain to determine whether the dentin is bacterially infected is clearly subjective at best and, at the worst, not supported by current science.

The dental explorer, at least in the United States, is frequently responsible for what is called caries. Despite litera-

ture to the contrary, the so-called stick or tug back of a sharp explorer is still used by clinicians and taught by some educators.^{13,14} The scientific argument against the use of an explorer was extensively reviewed by Stookey in 2005.¹⁵

As has been demonstrated, using the single-term caries is problematic. In the examples just cited, the single-term caries is unable to communicate the nuances between the radiographic appearance, clinical presence of stain, or even the stick of an explorer. Many educators and researchers are also guilty of adding to the confusion by not clearly defining or explaining the term caries in publications and oral presentations.⁹ Even when laboratory terms such as histologic caries, polarized light microscopy, and transverse microradiography are used in research manuscripts and oral presentations, the clinical relevance is rarely explained in

detail. For example, the fact that very small quantities of mineral loss measured by these laboratory procedures quite often have no clinical relevance when one has a patient in the chair trying to decide on when and if to restore a tooth surface. The use of the single-term caries, used to describe a variety of different situations leads to confusion. The lack of a common language to describe the temporal events of the caries process is a pitfall, and other systems and terminologies are being explored. One such system is the International Caries Detection and Assessment System, which proposes internationally accepted coding terminology to interpret both precavitated as well as cavitated stages of lesion formation.^{16,17}

Today's Terminology for Today's Management Strategies

Even though the disease of caries remains the same, today's science has dictated a new treatment paradigm; treating dental caries as an infectious disease. In February and March 2003, the *Journal of the California Dental Association* dedicated back-to-back issues to informing the profession of this paradigm shift.^{18,19} It included an extensive review of the science and terminated with a consensus statement of internationally known experts. Both of these journals are still accessible to the general public and can be downloaded at http://www.cdafoundation.org/news_journals.htm.

Dental caries is an infectious disease caused by mutans streptococci and lactobacillus, and is acquired by other humans. When these pathogens are exposed to dietary fermentable carbohydrates, these organisms produce small-chain acids that can diffuse into the tooth and dissolve tooth mineral. This chemical process is called demineralization.⁴ If the term caries is reserved to mean the infectious disease process

itself, then all subsequent changes to the tooth resulting from demineralization could be thought of as symptoms of the disease and not caries.

Many of these early changes are not visible to the naked eye. Early demineralization causes subsurface mineral loss, which eventually will refract visible light and appear as a white spot lesion.²⁰ If allowed to demineralize further, the mineral will become more porous and will pick up exogenous stain and appear as a brown spot lesion. The appearance and texture of the surface can often give clues of lesion activity.^{21,22} A dull and rough appearance often suggests that the lesion is in an active state of demineralization, and thus the term active carious lesion.

Just as acid was able to diffuse into the enamel and dissolve mineral, if the pH is first neutralized, the calcium phosphate, will eventually reach concentration equilibrium and can diffuse back into the tooth if conditions are right. This reversal of the demineralization process is called remineralization. Remineralization will occur if healthy saliva first neutralizes the acid, raising the pH, and provides the needed calcium and phosphate in solution to diffuse back into the tooth.⁴ The remineralization process is greatly enhanced by the presence of topical fluoride. In contrast to the dull and rough appearance of active demineralization, a remineralized surface will appear smooth and shiny, and can be considered as a sign of an inactive or arrested carious lesion. Another surface characteristic, which may be helpful in assessing activity on the dentin and cementum, is color. For example, a root or dentinal surface will appear tooth-colored to tan when actively demineralizing, and will turn to a dark brown to black color when arrested or remineralized. Thus, the demineralization and remineralization process can be thought of as nothing

more than a simple reversible chemical reaction that can be manipulated by the clinician to favor remineralization by simply manipulating the risk factors of the patient (caries management by risk assessment).

Summary

Although at times it is tempting to take the easy route and describe terms in **Figure 1** by simply saying caries, patients can be better served by clear universal communication in describing what is seen. More precise terms can better describe the temporal characteristics and activity of this dynamic disease process whereas the single-term caries cannot. This is increasingly more important when treating dental caries as an infectious disease, which includes prevention and chemical reversal of precavitated lesions, as well as early detection and minimally invasive restorative techniques for cavitated lesions. Dental caries may be the same old disease dentistry has labored to treat for centuries; the pathological and chemical events remain the same. However using precise terminology rather than the single-term caries will support appropriate patient care and will help eliminate confusion as well as reduce the chance of undertreatment and overtreatment. CDA

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To request a printed copy of this article, please contact / Douglas A. Young, DDS, MS, MBA, Department of Restorative Dentistry, University of the Pacific, Arthur A. Dugoni School of Dentistry, 2155 Webster St., San Francisco, 94115.