



**DR. JOSEPH WHITEHOUSE**

This month, two WCMID members (a father/son team, actually) present a detailed look at CAMBRA and explain why its “treat the cause” approach should be standard of care in all dental practices. —J.W.



This monthly column is co-sponsored by DPR and The World Congress of Minimally Invasive Dentistry. It is edited by Congress past-president Dr. Joseph Whitehouse.

# Manage caries: a minimally invasive approach

By V. Kim Kutsch, DMD and Carson Kutsch, DDS

**D**ental caries is a pandemic infection associated with the onset of enamel demineralization. Previously in this column, Drs. Young, Buchanan, Lubman and Budenz discussed the concept of caries as a bacterial infection, and proposed treating the infection in addition to treating the signs and symptoms as a standard of care. Caries is the disease or bacterial infection, now recognized as a biofilm disease; a carious lesion, cavitation, or cavity is merely a symptom of this disease. Thus, a medical model approach to management of caries by risk assessment and treatment of the bacterial infection has been developed and labeled CAMBRA, as an acronym for “caries management by risk assessment.” This concept deserves further discussion here.

## History of caries pathology

Bacterial plaque and the associated demineralization of enamel directly below the plaque were first reported by James Leon Williams in 1921. Shortly thereafter, Strep mutans and Lactobacilli were directly implicated in the formation of cavitated carious lesions. Since then, the primary treatment has focused on surgical intervention of the symptoms, but the concept of recognizing and treating the bacterial infection has early roots.

As early as 1924, G.V. Black proposed that dentistry should include an understanding of the pathology and nature of caries rather than focus principally on surgical intervention. However, since that time the dental profession has continued to concentrate

on surgical intervention, rather than addressing the bacterial infection as a disease proper. Caries is a steady-state disease with a variable expression over time. Surgical intervention of steady-state disease is inefficient, leading to continual treatment of the symptoms while never making progress against the etiology of the symptoms.<sup>1</sup>

## Biofilm: guilty as charged

We now recognize dental plaque as a sophisticated biofilm.<sup>2</sup> This biofilm develops rapidly on the teeth and forms a protective coating that reduces wear and maintains ionic stability with the enamel surface supporting the demineralization/remineralization process that maintains the integrity of the enamel.

In a normal, healthy oral biota, biofilm begins developing immediately with precipitation of salivary proline-rich casein-micelle globules. Calcium ions bridge between the globules, and within two hours, streptococcus bacteria adhere to the pellicle with exopolysaccharides and form a multilayered protein structure. Pioneering species generally include *S. sanguis*, *gordonii*, with co-aggregation of *A. naeslundii*. The biofilm then becomes anaerobic, consists of multiple bacterial species, and achieves structure and function. This climax community may be only 25 to 100 microns thick, develops in 24 hours, and is not stable for long periods.<sup>3</sup> While it is generally accepted that “clean” teeth do not decay, brushing and flossing does not remove this thin biofilm. The presence of thick plaque does not necessarily result in cavitation, and a clean-appearing tooth may have a cariogenic biofilm.

Under certain conditions, normal, healthy biofilm may be replaced by cariogenic biofilm. In normal biofilm, acidogenic/aciduric bacteria like Mutans streptococci and Lactobacilli account for about 1% of the bacteria; while in a cariogenic biofilm, these bacteria make up to 96%. At this point, the pH of the biofilm becomes acidic, and the low pH favors additional aciduric bacterial species and drives the loss of calcium and phosphate mineral from the enamel.<sup>4</sup> In the low pH biofilm, the cariogenic bacteria have a high metabolic rate and expend a great deal of ATP to pump H<sup>+</sup> ions out of the cell to maintain intracellular neutrality.<sup>5</sup> To effectively treat dental caries, the teeth must not only be restored to function, but the cariogenic biofilm needs to be restored to a

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**The hierarchy of caries risk** Treatment should be recommended according to patients’ individual risk assessment. (A) This high-risk patient with a high active caries process has numerous active lesions that are progressing rapidly to destroy teeth. (B)

This high-risk patient with a low active caries process has multiple risk factors, but presents with few white-spot lesions; the open cavitations have been progressing over 20 years. (C) This moderate-risk patient has numerous white-spot lesions that will lead to cavitations if left untreated. (D) This low-risk patient has no open cavitations, no white-spot lesions, and low risk factors.

## Risk assessment QUESTIONS

Does the patient seek regular re-care appointments?

What is their decay experience like?

Have they had any cavitations restored in the past three years?

Does the patient demonstrate good oral hygiene with daily brushing, and do they really floss?

What type of toothpaste do they use, and does it contain fluoride?

Do they also use an over-the-counter fluoride rinse?

Are there visible active cavitations, white spot lesions, or evidence of radiographic caries?

What is the patient's attitude toward dentistry and their oral health?

Does the patient snack more than three times per day between meals?

Do they chew gum and drink sodas, and are these sugarless or diet?

Do they use any xylitol-based products?

Are they currently using any antimicrobial agents?

(A review of the dietary habits of the patient confirms the presence of fermentable carbohydrates. It is important to determine the frequency of these carbohydrates, the timing, and the type. The frequency and the resulting demineralization/remuneration cycle is more important than the type of snack. How many carbohydrates and how often they are ingested are important factors in risk assessment.)

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healthy biofilm.

### Beyond treating symptoms

Medical management of caries is not a new concept, but it has not been implemented in practice on any significant scale. One problem has been a lack of a nationally recognized, validated, and universal agreed-upon caries treatment protocol. This is changing.

Most dental schools now incorporate caries risk assessment as a standard practice, and the ADA even recognizes the need for risk assessment as a standard of care. Many dental schools are now working together to create universal forms and protocols. The necessary paradigm shift that practicing dentists must now recognize is that treating the symptoms alone does not treat the underlying bacterial infection.<sup>6</sup> It has been commonly thought by the dental profession that caries control could be accomplished exclusively by eliminating the cavitations, good oral hygiene, and proper diet, with fluoride thrown in for good measure. This treatment model repeatedly demonstrates its ineffectiveness and failure with its illogical management of a bacterial infection. Almost all dentists have had the clinical experience with a high-risk, high active-caries patient, where filling the teeth resulted in only momentary relief of pain and restoration of the teeth to function, while the teeth could not be filled fast enough to prevent new cavitations. They could not keep up with the disease. And most clinicians also have had the experience of providing a makeover to these patients without treating the in-

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## Cariogenic bacteria screening

ATP bioluminescence is a valuable technique for determining the presence of cariogenic bacteria. After swabbing a tooth (A), the biofilm is cultured (B). The vial on the left is from a low-risk patient. The vial on the right, from a high-risk patient, shows high counts of Mutans streptococci CFUs.



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fection, delivering 20 esthetic veneers and crowns, only to see the patient a year later with recurrent decay.

The plaque theory doesn't hold water, and the surgical model doesn't work clinically! The infection must be identified, diagnosed, treated, and monitored independently of or in addition to treating the symptoms. Otherwise, the patient will continue to live with the infection, along with recurring symptoms.

## A delicate balance

The Featherstone Caries Balance model includes examining additional necessary factors such as the saliva production and pH, while combining antimicrobials in creating a stable oral environment that results in optimal oral health.<sup>7</sup> There are numerous protective factors that can be employed to create a healthy balance for a patient, but the first step is getting an accurate diagnosis and disease risk assessment. Caries risk assessment includes examination of the patient's medical history, dental history, diet, saliva, and colony forming units of acidogenic bacteria in the saliva. There are many medications, ranging from antihistamines to anti-hypertensives, that result in reduced salivary function. Other medical conditions such as Sjögren's syndrome often have accompanying xerostomia. A history of radiation therapy to the head and neck may result in reduced salivary function. Drug abuse manifests itself by increasing caries risk, as methamphetamines produce a dry mouth and the addicts frequently crave diets based on simple sugars. In addition, salivary function decreases naturally with advancing age and may tip the caries balance. As taste bud function also decreases with age, senior patients may complicate matters by adding more sugar directly to their food.

## Ask the right questions

Several other factors to consider during the medical history review regard whether the patient may have some physical or mental limitations. The dental history is also an important review in determining the patient's caries risk assessment. See the sidebar on page 20 for a list of salient questions; and see page 140 for instructions on how to download a sample CAMBRA risk assessment questionnaire.

By adding this detailed information to a thorough oral exam, a clearer picture of the patient's disease status and risk emerges.<sup>8</sup> During the exam, it is important to visually assess if there is adequate saliva.

Other moderate risk factors include exposed root surfaces and deep pits and fissures. If enough risk factors are present, or pathogenic risk factors outweigh protective risk factors, further testing and treatment of the biofilm are recommended.

## New weapons

A new approach to diagnosing and treating caries requires new language, proce-

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## Hoya con bio

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dures, instruments, materials, and education. Currently available products include standardized risk assessment forms, bacterial cultures, and xylitol and fluoride rinses, toothpastes, gums, and mints.

New products include ATP bioluminescence, rapid culture techniques, and oral

care products that are antimicrobial in nature. Because the cariogenic bacteria use a tremendous amount of ATP to maintain intracellular neutrality, ATP bioluminescence offers a potential screening test for cariogenic bacteria in the biofilm.<sup>9,10</sup>

By swabbing the tooth surface and measuring the ATP level present, the cariogenic

potential of the biofilm may be estimated. A quick and simple low-cost screening test allows clinicians to routinely monitor caries risk for their patients. While the ATP level is non-specific and does not identify specific bacteria in the biofilm, it does show promise as an accurate screening test. Rapid cultures are utilized for a number of deter-

minations, and a rapid culture for *Mutans streptococci* gives the dentist a valid level of these known pathogens in the patient's biofilm (see photos on page 22). Numerous studies over the past 25 years have established the relationship between these bacterial levels and the incidence, severity, and rate of dental caries.<sup>11</sup> By monitoring the bacterial levels, clinicians can measure the effectiveness of the caries treatment on the biofilm.<sup>12</sup> New antimicrobial oral care products provide short-term therapy against the cariogenic biofilm and long-term maintenance for a healthy biofilm. Most of the currently available oral rinses are low pH, while part of the caries therapy goals should include raising the pH of the biofilm, to favor normal bacteria.

### Developing a treatment plan

Combining all of this data, the dentist can develop a caries risk assessment and treatment recommendation for the individual patient. The patient is classified as low, moderate, high, or even extreme risk for caries, and their activity is assessed (see photos on page 18 for examples). It is important that the patient understand the caries balance, and what will be required to not only treat their cavitations but eliminate or control the cariogenic biofilm disease as well. The patient should also understand the nature of the caries balance and that their caries risk factors may change over time. For example, a patient may begin taking a xerostomia-producing medication years into the future, and they need to understand how this might affect their caries balance and oral health. Risk factors change over time and need to be assessed on an ongoing basis.

All treatment recommendations should be designed around the patient's individual risk assessment. Providing the right protective factors can get the patient under control or compliant, and in achieving a healthy balance. The protective factors must outweigh the pathologic factors to achieve success. The cavitations need to be treated concurrently with the caries treatment, and depending on the patient, the risk assessment may influence the best choice of restorative material. When restoring a high- or extreme-risk patient, glass ionomer would be the material of choice whenever possible. The patient might even require treatment stages involving treating the infection first, followed by treating all cavitations with glass ionomer and achieving and documenting successful compliance before proceeding to definitive restorations.

### Conclusion

While there is yet no standardized, agreed-upon, and validated regimen currently available for caries treatment, promising validated research is currently underway. Dental schools are working together to standardize care and recommendations. The World Congress of Minimally Invasive Dentistry is committed to educating the profession and the public about the medical model of dentistry. Dental Boards, Public Health and

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third-party agencies are examining this issue. Dental journals are staying abreast of current developments as researchers and clinicians continue to collect data. New and promising diagnostic and treatment tools and materials are coming to the market. One thing is certain: Without the CAMBRA

data, simply diagnosing and treating the patient's cavities with the traditional surgical model is outdated and ineffective, and it does not result in long-term health for the patient. **DPR**

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All photos courtesy of Dr. V. Kim Kutsch

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