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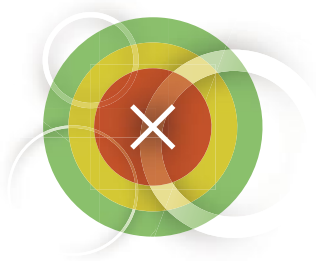

Curing the Silent Epidemic: Caries Management in the 21st Century and Beyond

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ABSTRACT Caries is the most prevalent disease of children and is epidemic in some populations. A risk-based approach to managing caries targets those in greatest jeopardy for contracting the disease, as well as provides evidence-based decisions to treat current disease and control it in the future. This paper outlines key concepts necessary to effectively manage and reduce caries based on the most current science to date. Subsequent articles will outline a roadmap to success in curing dental caries.

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The Silent Epidemic

"What amounts to 'a silent epidemic' of oral diseases is affecting America's most vulnerable citizens: poor children, the elderly, and many members of racial and ethnic minority groups."

— THE SURGEON GENERAL 2000 U.S. Department of Health and Human Services, 2000 Oral Health in America: A Report of the Surgeon General, Rockville, Md., U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.

Dental caries, also known as the process leading to tooth decay, is the pathologic progression of tooth destruction by oral microorganisms that can affect individuals of all ages, cultures, ethnicities, and socioeconomic backgrounds. In 2000, it was determined that dental caries was the most common chronic disease of childhood, with a rate five times greater than that seen for the next most prevalent disease of childhood: asthma.[1] Because dental infections are common and usually nonlife-threatening in nature, the significance of dental caries in overall health has historically been minimized until recently. On Feb. 28, 2007, the *Washington Post* reported that a 12-year-old Maryland boy died from untreated tooth decay. This news received national attention, not only from the dental profession but the public in general. Although overall dental caries prevalence and severity has been notably reduced in several western countries over the past couple of decades, dental caries continues to be a major health issue in the United States.

The third National Health and Nutrition Examination Survey (NHANES III)-Phase 1, collected data from 1988 to 1994 that indicated 50 percent of 5- to 8-year-old children in the United States had experienced caries in the primary dentition.[2] Remarkably, when the data are examined,

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approximately 25 percent of children and adolescents in the 5- to 17-year-old range accounted for 80 percent of the caries experienced in the permanent teeth. These data indicate that dental caries continues to be a major oral health concern in children in the United States and worldwide.[3] This suggests that the population of individuals susceptible to dental decay continues to expand with increased age. It is evident from numerous other studies that dental caries continues to affect individuals through childhood and beyond.[3]

Much of the dentistry is focused on restoring the symptoms of this transmissible bacterial infection rather than treating its etiologic cause, the infectious cariogenic biofilm in a predominantly pathologic oral environment. The core principles supporting risk-based caries management are decades old, and many practitioners are already using this as their current standard approach in patient care. Many clinicians still need help getting started with employing these principles in their practice.

This issue of the *Journal* provides current information on how to assess caries risk, what to do as a result, and provides the protocols to implement it in practice. The articles emphasize practical suggestions on how these current management techniques may be efficiently incorporated into a dental practice. This paper will present key concepts necessary for the most current management of dental caries and sets the stage for subsequent papers in this issue to cover the clinical implementation of a caries management by risk assessment model, or CAMBRA.

Caries Management by Risk Assessment

For more than two decades, medical science has suggested that physicians identify and treat patients by risk rather than treating all patients the same.[4] Throughout this *Journal*, the authors will refer to an evidence-based disease management protocol for Caries Management by Risk Assessment, or CAMBRA.[5] Evidence-based dentistry, as defined by American Dental Association Council on Scientific Affairs in 2006, is an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence relating to the patient's oral and medical condition and history, with the dentist's clinical expertise and the patient's treatment needs and preferences (www.ada.org/prof/resources/pubs/jada/reports/index.asp).

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Simply put, with the CAMBRA methodology the clinician identifies the cause of disease by assessing risk factors for each individual patient. Based on the evidence presented, the clinician then corrects the problems (by managing the risk factors) using specific treatment recommendations including behavioral, chemical, and minimally invasive procedures. Both the risk assessment and interventions are based on the concept of altering the Caries Balance (see Featherstone, et al. this issue). The Caries Balance is a model where pathological factors (bacteria, absence of healthy saliva, and poor dietary habits (i.e., frequent ingestion of fermentable carbohydrates) battle protective factors (saliva and sealants, antibacterials, fluoride, and an effective diet).[6] With the use of CAMBRA, there is evidence that early damage to teeth from dental caries may be reversed and the manifestations of the disease perhaps prevented all together.

Transitioning From Science to Practice

In February and March 2003, two issues of the *Journal of the California Dental Association* were dedicated to reviewing the scientific basis for CAMBRA, culminating with a consensus statement of national experts and the production of risk assessment forms. The California Dental Association, through the CDA Foundation, has made these journals available to the public at www.cdafoundation.org/journal. These issues of the *Journal* present reviews of the scientific literature on the caries process starting with the infectious nature of the pathogenic bacterial organisms that are part of an extremely complex biofilm community.[7] These organisms utilize fermentable carbohydrates as an energy source and create small molecule acids that then enter the tooth via diffusion channels between the mineral crystals. The diffusion of acid causes mineral loss below the tooth surface and, if the process is not halted, the surface will cavitate. In the case of a noncavitated lesion, it is possible to halt or reverse the caries process. In this case, using the Caries Balance, the protective factors overcome the pathological factors and remineralization of the lesion is possible and preferred.[8] Remineralization is the natural repair process for dental caries. Several articles in those *Journals* reviewed the individual chemotherapeutic agents such as xylitol, chlorhexidine, iodine, fluoride, as well

as fluoride releasing dental materials.[9-13]

More recently, a pivotal randomized clinical trial by Featherstone et al. investigated CAMBRA protocols compared to conventional care.[14] In the intervention group, patients were assessed at levels of caries risk based upon the Caries Balance described previously. Depending upon their risk status, patients were treated with antibacterial therapy (chlorhexidine) to reduce the bacterial challenge and topical fluoride (daily fluoride mouthrinse) to enhance remineralization. The control group received examination, customary preventive care and restoration as needed, but no risk assessment or chemical interventions. Results showed a significant reduction of cariogenic bacteria and future carious lesions in the CAMBRA test group compared to the conventional care control group.[14]

Since the science of CAMBRA has been well-cited in the literature, clinicians are increasingly placing this knowledge into practice to the benefit of their patients. This issue of the *Journal* will present ways to incorporate CAMBRA into practice and will be added as a resource to the previously mentioned Web site. Protocols mentioned in this *Journal* are suggestions based on the best available scientific evidence to date as well as clinical practice in offices currently using the CAMBRA approach. It is meant to be a starting point to aid the offices that have not yet incorporated CAMBRA principles. This issue also contains updated risk assessment forms and procedures that should be adopted by those currently utilizing CAMBRA as the changes are based upon experience to date. This effort will continue to be updated as new research science and dental products are incorporated into the dental marketplace.

Why Define Terminology?

Changing paradigms in caries management does not happen without global involvement and collaboration from several sources, including updating terminology to reflect new scientific advances. Existing terminology does not always accurately reflect new advances in science. However, new terminology is not always universally accepted as new concepts are often described with different definitions, names, or labels. Some feel there should be globally accepted terminology, while others want the freedom to apply terminology that is more locally accepted. In any case, caries management by risk assessment accurately describes the new paradigm of treating the caries disease process and will be used throughout this *Journal*. Alternative terminology that has been used in the past includes the "medical model" or the "modern management of caries." The limitations with these terms is that they do not describe the disease process.

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CARIES

The term caries has been used to describe a multitude of manifestations, which may lead to confusion if not further defined.[15] For purposes of this *Journal*, caries is defined as an infectious transmissible disease process where a cariogenic biofilm in the presence of an oral status that is more pathological than protective leads to the demineralization of dental hard tissues.

Any resulting changes, visible on the teeth or not, are merely symptoms of this disease process. Therefore, caries is not a hole in the tooth, cavitation, nor should it be used to describe everything clinically detectable. Throughout this *Journal* there will be clear use of other descriptive terminology when referring to the symptoms of caries such as cavitation, carious lesions, radiographic caries, white or brown spot lesions, infected dentin, affected dentin, and so on.

CAMBRA, MID, AND MI

Minimally invasive dentistry, minimal intervention, and CAMBRA are relatively new terms developed in response to scientific advances in the field. They are used interchangeably by some, and by others a source of debate about which is the most proper term. For example, CAMBRA does not stop at prevention and chemical treatments; it includes evidence-based decisions on when and how to restore a tooth to minimize structural loss. In addition, minimally invasive dentistry and minimal intervention stand for much more than conservative cavity preparation. The term "minimal intervention" was endorsed by the Federation Dentaire Internationale in a 2002 policy statement and is globally recognized.[16] The terms CAMBRA and MID are in 100 percent agreement with the FDI statement on minimal intervention. Thus, the authors support the interchangeability of all three terms and recognize the importance of local preferences as well as global collaboration.

DETECTION VERSUS DIAGNOSIS

Defining the terms detection and diagnosis as it relates to dental caries is best

done by example. Simply put, one *diagnoses* the caries disease but *detects* carious lesions. Detecting a white spot lesion, for example, is not diagnosing the disease of caries because the disease process involved with the lesion could be inactive and the lesion could be remineralized.

PREVENTION VERSUS MANAGING RISK FACTORS

Traditionally, the term "prevention" has become a common language term that has been blanched and simplified to only mean "brush and floss" and "don't eat sugar." That advice is historically what many consider when the term is used in the context of caries prevention. Utilizing CAMBRA archetype, managing risk factors is what is done after first performing caries risk assessment. Once the risk factors are identified, then evidence-based treatment decisions can be made to bring the balance of pathologic and protective factors positively back to favor health using an array of behavioral, chemical, minimally invasive surgical, and other techniques. Throughout this issue of the *Journal* the term prevention will be defined as risk factor management (by maximizing protective factors and minimizing pathological factors).

Western CAMBRA Coalition

The Western CAMBRA Coalition is a unique collaboration of diverse groups of independent organizations. This coalition represents an interorganizational collaboration that has evolved over four years and has led to significant progress in the clinical adoption of CAMBRA. The working group, assembled from different aspects of the dental profession, included unofficial representatives of education from all five California dental schools, as well as from Oregon, Washington, Nevada, and Arizona. Additionally, representatives from research, industry, the California Dental Association Foundation, government, the Dental Board of California, third-party payers, and private practice clinicians were included in the working group. The strategy for including a diverse perspective of individuals was to break the traditional mold where only researchers, educators, and clinicians met for their specialties. The goal was to infuse new ideas into the conversation where no existing network for sharing this information existed.

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Additionally, the cross-pollination provided support from nontraditional partners to implement changes in caries management. The coalition used this conduit of information based on reciprocity so that those in the network could share information freely and confidentially in the spirit of cooperation, collaboration, and coordination for the common good of improving the standard of caries management.

The coalition has used the World Congress of Minimally Invasive Dentistry annual meeting, attended mostly by clinicians, as a venue to gather each year because CAMBRA is a core value of the WCMID (www.wcmid.com). Recently, new CAMBRA groups in the Eastern and Central United States have formed and begun to meet with the same agenda and principles as the Western CAMBRA Coalition. The regional groups have agreed to work together and collaborate with the newly formed ADEA Cariology Special Interest Group where opportunities exist.

Standard of Care

Standard of care involves many components and is more than just what a dentist does in his/her own practice, what a dental school teaches, or even what is published in refereed publications. Standards are never static, nor is there always complete agreement on the application. The California legal system defines the standard of care as what a reasonably careful dentist should do under similar circumstances. Reasonable care weighs the benefits versus the risks. If the benefits exceed the risks, then reasonable dentists should adopt these standards. The public expects that dentists and physicians will utilize current scientifically safe and effective practices.

CAMBRA procedures, as presented in this issue of the *Journal*, provide a framework for providing caries management by risk assessment for the benefit and improved dental health of the patient. Explaining the planned treatment to the patient and obtaining informed consent is, of course, necessary as part of this approach, as it is for any procedure. Although the CAMBRA protocols are based on the best available science we have now, there is much more involved in treatment decisions other than just science. As stated previously, the ADA definition of evidence-based dentistry implies that treatment decisions should also consider the clinical expertise of the clinician and, most importantly, the preferences of the fully informed patient just as much

as the science (www.ada.org/prof/resources/topics/evidencebased.asp).

Conclusions

It is the consensus of the Western CAMBRA Coalition that it is best for the profession to position itself for the future and embrace caries management by risk assessment. This means thinking of dental caries as a disease process with the possibility of intervention, arresting the progress of the disease, and even reversing it. Caries risk assessment should become a routine part of the comprehensive oral examination, and the results of the assessment should be used as the basis for the treatment plan.

This issue of the *Journal* provides caries risk assessment and treatment procedures for newborns to age 5 (Ramos-Gomez et al.); caries risk assessment for age 6 through adult (Featherstone et al.); caries management based on risk assessment (Jenson et al.); and dental products available for use in the CAMBRA approach (Spolsky et al.).

In summation, the Western CAMBRA Coalition urges that all dentists implement CAMBRA in their practices for the benefit of their patients and the improved oral health of the nation. The time to do it is now. The tools and rationale are provided in the following pages. ■■■■

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