

# Oral Health Topics

## Caries Risk Assessment and Management

### Key Points

- Caries is a continuum of disease states of increasing severity and tooth destruction, ranging from subclinical changes at the molecular level to lesions involving the dentin, either with an intact surface or obvious cavitation.
- The formerly practiced paradigm of “drill and fill,” drilling out pits and fissures or surgically removing decayed and diseased tissue and placing permanent restorations, does not address the full continuum of the caries disease process, including microbial activity and the balance between enamel remineralization and demineralization.
- Systematic methods of caries detection, classification, and risk assessment, as well as prevention/risk management strategies, can help to reduce patient risk of developing advanced disease and may even arrest the disease process.

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### Introduction



Dental caries, or tooth decay, is most prevalent infectious disease in humans, affecting 97% of the population worldwide during their lifetimes.<sup>1</sup> The term “caries” can be used to describe both the disease process and the lesion (noncavitated or cavitated) that is formed as a result of the disease process.<sup>2</sup> One definition of caries is “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.”<sup>3</sup>

The process of caries is multifactorial and, over time, can culminate in localized destruction of hard dental tissues by the weak acids produced by bacterial carbohydrate fermentation.<sup>2</sup> Microbiological shifts within the oral biofilm upset the balance of the tooth enamel remineralization/demineralization process; this balance is also affected by salivary flow and composition, fluoride exposure, consumption of dietary sugars, and preventive behaviors (e.g., brushing teeth).<sup>2</sup> Whether dental caries progresses, is halted, or reverses depends on a balance between protective and pathogenic factors.<sup>4</sup>

Caries is a continuum of disease states of increasing severity and tooth destruction, ranging from subclinical changes at the molecular level to lesions involving the dentin, either with an intact surface or obvious cavitation.<sup>2</sup> The formerly practiced paradigm of “drill and fill,” drilling out pits and fissures or surgically removing decayed and diseased tissue and placing permanent restorations, does not address the full continuum of the caries disease process.<sup>2, 5</sup> Arresting or preventing the caries process from resulting in cavitated lesions requires careful and systematic methods for documenting and monitoring disease at early stages and intervening prior to the development of advanced lesions.

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### Detection of Caries/Caries Classification and Risk Assessment Systems



## Caries Detection

Obvious caries lesions may be seen on simple visual clinical examination.<sup>2</sup> Tactile methods, e.g., the use of an explorer or ball-tipped dental probe, provide adjunctive information on evidence of enamel softness, although there may be concerns about the potential for iatrogenic damage to the enamel surface and promotion of caries initiation or progression.<sup>2, 6</sup> Radiographs, e.g., bitewings, can detect lesions on contacting approximal surfaces;<sup>2</sup> however, systematic review of the literature on this method of caries detection showed an overall sensitivity of approximately 50% and a specificity of around 87%.<sup>7</sup>

## Newer Detection Technologies

CDT 2017 contains a code<sup>8</sup> that will enable dentists to document techniques for detection and diagnosis of decay without the use of ionizing radiation. This code, titled “nonionizing diagnostic procedure capable of quantifying, monitoring, and recording changes in structure of enamel, dentin, and cementum,” anticipates that the dentist delivering the procedure will determine the equipment and protocol best suited for the patient.

Examples of detection technologies for which this code might be applicable are laser fluorescence, transillumination or a combination of noncontacting modulated laser luminescence and photothermal radiometry. Devices may have specific applications for which their technology may be especially well suited or they may have more broad utility. The May 2015 issue of the ADA Professional Product Review includes a matrix to facilitate comparison of the features and claims made by the device manufacturers.<sup>9</sup>

The 2015 ADA CSA Report on the ADA Caries Classification System (CCS, discussed below) notes that evidence-based adjunctive aids to detect caries lesions, such as fluorescence-based techniques or other light-based caries diagnostic tools, are “emerging and, as they are developed, clinically tested and validated, they may contribute to a more precise placement of caries lesions within the ADA CCS categories.”<sup>10</sup>

## Classification and Risk Assessment Systems

Caries management by risk assessment (CAMBRA) is a methodology by which clinicians identify the cause of caries by assessing the presence of risk factors for each individual patient.<sup>3</sup> Based on the presenting risk factors, the clinician can then correct for each, using specific treatment recommendations, including behavioral, chemical, and minimally invasive procedures.<sup>3</sup>

The International Caries Detection and Assessment System (ICDAS) is an evidence-based, preventively oriented strategy that classifies the visual appearance of a lesion (i.e., detection, whether or not disease is present), characterization/monitoring of the lesion once detected (i.e., assessment), and culminates in diagnosis.<sup>11</sup> The ICDAS is scored on clean, dry teeth; the system cautions against using sharp explorers or probes in order to prevent iatrogenic damage to the tooth.<sup>11</sup>

The ICDAS classification criteria, and associated estimates of caries activity, are based upon the histological extension of lesions spreading into tooth tissue.<sup>11</sup> The scores are on a 7-point rating scale, as follows:

0	Clinically sound
1 to 2	Clinically detected “intact” enamel lesions
3	Clinically detectable cavities, limited to enamel
4 to 5	Clinically detected lesions extending to dentin

The International Caries Classification and Management System™ (ICCMS™) takes the results of the ICDAS classification and translates it into a risk-assessed caries management system individualized for the patient.<sup>11</sup> The key elements of ICCMS<sup>11</sup> are:

- Initial patient assessments (collecting personal and risk-based information through histories and systematic data collection);
- Lesion detection, activity, and appropriate risk assessment (detection and staging of lesions, assessment of caries activity, and caries risk assessment);
- Synthesis and decision making (integrating patient-level and lesion-level information); and
- Clinical treatments (surgical and nonsurgical) with prevention (ensuring that the treatment planning options available are prevention oriented and include nonsurgical options whenever appropriate).

ADA CCS<sup>10</sup> incorporates the ICDAS and other classification systems into a broader classification system that also incorporates radiographic presentation of the approximal surface and the clinical presentation. The ADA CCS is conducted on clean teeth, using compressed air, adequate lighting, and a rounded explorer or ball-end probe. Radiographs should also be available. The ADA CCS is designed to include both noncavitated and cavitated lesions and to “describe them by clinical presentation without reference to a specific treatment approach.” In addition, the ADA CCS—contrasted with some caries classification systems—links “clinical lesion presentation to radiographic findings and provides an approach to identify, when possible, caries lesion activity over time.”

ADA Caries Risk Assessment forms<sup>12, 13</sup> categorize a patient’s overall risk of developing caries, based on history and clinical examination. The forms are designated for patients ages 0 to 6 years<sup>14</sup> and older than 6 years.<sup>13</sup>

Characteristics that place a patient at high caries risk include:

- Sugary Foods or Drinks: Bottle or sippy cup with anything other than water at bedtime (ages 0 to 6 years) or frequent or prolonged between meal exposures/day (ages >6 years)
- Eligible for Government Programs: WIC, Head Start, Medicaid or SCHIP (ages 0 to 6)
- Caries Experience of Mother, Caregiver and/or other Siblings: Carious lesions in the last 6 months (ages 0 to 14 years)
- Special Health Care Needs: developmental, physical, medical or mental disabilities that prevent or limit performance of adequate oral health care by themselves or caregivers (ages 0 to 14 years)
- Chemo/Radiation Therapy (ages >6 years)
- Visual or Radiographically Evident Restorations/Cavitated Carious Lesions: Carious lesions or restorations in last 24 months (ages 0 to 6 years)
- Non-cavitated (incipient) Carious Lesions: New lesions in the last 24 months (ages 0 to 6 years)
- Cavitated or Non-Cavitated (incipient) Carious Lesions or Restorations (visually or radiographically evident): 3 or more carious lesions or restorations in last 36 months (ages >6 years)
- Teeth Missing Due to Caries: Any (ages 0 to 6 years) or in the past 36 months (ages >6 years)
- Severe Dry Mouth (Xerostomia; ages >6 years) or Visually Inadequate Salivary Flow (ages 0 to 6 years)

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## **Caries Prevention and Risk Management Strategies**

### **Behavioral Modification: Oral Hygiene and Diet**

Patients, especially those at high risk of caries development, should be instructed to reduce the amount and frequency of carbohydrate consumption.<sup>14</sup> Patients should limit sugary snacks between meals<sup>15</sup> and eat a healthy diet that limits added sugars and high-acid foods that can affect mineralization of enamel.<sup>15</sup> Encourage patients to chew sugar-free gum with xylitol, which can promote salivary flow, remineralization, and block sucrose metabolism by cariogenic bacteria.<sup>16</sup> All patients should be educated in optimal oral hygiene practices, including brushing with

fluoride toothpaste twice a day and cleaning between teeth daily. Although some caries prevention recommendations<sup>5</sup> include use of topical antimicrobials (e.g., chlorhexidine rinse) in patients 6 years of age and older who are at high risk of caries, a 2015 Cochrane systematic review found no trials for the use of antimicrobial chlorhexidine mouth rinses, sprays, gels, or chewing gums to prevent caries in children and adolescents.<sup>17</sup>

### **Fluoride Application**

A 2013 systematic review<sup>18</sup> from the ADA CSA Expert Panel on Topical Fluoride Caries Preventive Agents provided evidence-based clinical recommendations regarding professionally applied and prescription-strength, home-use topical fluoride agents for caries prevention. Evidence was sought from clinical trials of professionally applied and prescription-strength topical fluoride agents—including mouthrinses, varnishes, gels, foams and pastes—reporting on caries increment outcomes. Clinical recommendations included the following for people at risk of developing dental caries:

The panel recommends the following for people at risk of developing dental caries: 2.26% fluoride varnish or 1.23% fluoride (acidulated phosphate fluoride) gel, or a prescription-strength, home-use 0.5% fluoride gel or paste or 0.09% fluoride mouthrinse for patients 6 years or older. Only 2.26% fluoride varnish is recommended for children younger than 6 years. The strengths of the recommendations for the recommended products varied from “in favor” to “expert opinion for.” As part of the evidence-based approach to care, these clinical recommendations should be integrated with the practitioner’s professional judgment and the patient’s needs and preferences.

Silver diamine fluoride 38% (Advantage Arrest™, Elevate Oral Care, L.L.C.) was cleared for marketing in 2015 by the U.S. Food and Drug Administration for treating dentinal hypersensitivity in adults.<sup>19</sup> A new CDT code<sup>20</sup> for 2016 is D1354—interim caries arresting medicament application: “Conservative treatment of an active, non-symptomatic carious lesion by topical application of a caries arresting or inhibiting medicament and without mechanical removal of sound tooth structure.” This new code allows for coding the off-label use of silver diamine fluoride for caries arrest.<sup>21</sup>

### **Pit-and-Fissure Sealants**

Anatomical grooves, or pits and fissures on occlusal surfaces of permanent molars can trap food particles and promote the presence of bacterial biofilm, increasing the risk of developing caries lesions. Effectively penetrating and sealing these surfaces with a dental material, e.g., pit-and-fissure sealants, can prevent lesions and is part of a comprehensive caries management approach.<sup>22</sup> From a secondary prevention perspective, there is evidence that sealants also can inhibit the progression of non-cavitated caries lesions.<sup>23</sup> The use of sealants to arrest or inhibit the progression of caries lesions is important to the clinician when determining the appropriate intervention for non-cavitated caries lesions.

Based on a systematic review, a 2016 guideline panel convened by the ADA CSA and the American Academy of Pediatric Dentistry (AAPD) came to the following evidence-based clinical recommendations for the use of pit-and-fissure sealants on the occlusal surfaces of primary and permanent molars in children and adolescents.<sup>24, 25</sup>

- sealants are effective in preventing and arresting pit-and-fissure occlusal caries lesions of primary and permanent molars in children and adolescents compared to the non-use of sealants or use of fluoride varnishes; and
- sealants can minimize the progression of non-cavitated occlusal caries lesions (also referred to as initial lesions) that receive a sealant.

Based on available limited evidence, the panel was unable to provide specific recommendations on the relative merits of one type of sealant material over the others. The report defined pit-and-fissure sealant materials as follows: 1) resin-based sealants, 2) glass ionomer cements or sealants, 3) polyacid-modified resin sealants, and 4) resin-modified glass ionomer sealants.<sup>22</sup>

## References

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## **ADA Resources**

- [Search JADA](#) for articles related to dental caries
- Search the [ADA Catalog](#) for products related to dental caries
- [ADA Library Services](#)
- ADA Professional Product Review: [Caries Detection Devices](#)

### **ADA Caries Risk Assessment Forms**

- [Download Instructions](#) (PDF)
- [Caries Risk Form \(Patients Ages 0-6 Years\)](#) (PDF)
- [Caries Risk Form \(Patients Over 6 Years\)](#) (PDF)

### **ADA Caries Risk Assessment Forms (For Dental Education Use Only)**

- [Caries Risk Form \(Patients Ages 0-6 Years\)](#) (PDF)
- [Caries Risk Form \(Patients Over 6 Years\)](#) (PDF)

### **Early Childhood Caries Symposium**

- [Panel Report: Symposium on Early Childhood Caries in American Indian and Alaska Native Children](#) (PDF)

### **ADA Positions and Statements**

- [ADA Statement on Early Childhood Caries](#)

### **ADA Public Service Announcements**

- [Dudley and Friends Educational Videos](#)

### **Evidence-based Clinical Recommendations**

- [Clinical Practice Guideline](#) and [Systematic Review](#): Sealants for Preventing and Arresting Pit-and-Fissure Occlusal Caries in Primary and Permanent Molars (2016)
- [Topical Fluoride for Caries Prevention](#) (2013)
- [Non-Fluoride Caries Preventive Agents](#) (2011)
- [Fluoride Supplements](#) (2010)

### **Patient Resources**

ADA MouthHealthy:

<a href="#">Baby Bottle Tooth Decay</a>
<a href="#">Cavities</a>
<a href="#">Decay</a>
<a href="#">Sealants</a>

JADA “For the Patient” pages

[Tackling Tooth Decay](#)  
[Dental Sealants](#)

ADA Catalog: [Tooth Decay Brochure](#) (Item #W303)

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## **Other Resources**

Mayo Clinic: [Cavities/Tooth Decay](#)

MEDLINE Plus (U.S. National Library of Medicine): [Tooth Decay](#)

National Institute for Dental and Craniofacial Research: [Tooth Decay \(Caries\)](#)

Smiles for Life [Oral Health App](#)

Systematic Reviews

- [A Systematic Review of Dental Disease in Patients Undergoing Cancer Therapy](#) (May 2010)
- [Early Childhood Caries and Mutans Streptococci: A Systematic Review](#) (2010)

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