

Nonsurgical Treatment of Incipient and Hidden Caries

Van P. Thompson, PhD, DDS^{a,*},
James M. Kaim, DDS^b

^a*Department of Biomaterials & Biomimetics, New York University College of Dentistry,
345 East 24th Street, 804S, New York, NY 10010, USA*

^b*Department of Cariology & Operative Dentistry, New York University College of Dentistry,
345 East 24th Street, VA16N, New York, NY 10010, USA*

Treatment of the infection resulting in caries can be classified as surgical or medical. The traditional assumption has been that surgical removal of the carious tissue and defective restorations is sufficient; however, it is now known that surgical treatment without addressing the risk factors for caries that are responsible for the disease will only lead to new lesions and repair or replacement of failing or failed restorations. Medical treatment of caries in a partnership with patients should go hand in hand with any necessary surgical treatment [1]. Caries-associated bacteria are present at some level in all dentate individuals. When biofilms on teeth can mature undisturbed and are provided with a source of fermentable carbohydrates, a significant decalcification and breakdown of enamel and dentin is possible [2,3]. Caries with cavitation should be treated surgically; however, if the enamel remains visually intact, the potential exists to reverse the demineralization even though it might, in the case of proximal lesions, extend radiographically to dentin [4,5]. Remineralization of carious lesions has been studied extensively in animal models [6]. The medical approach to caries management can only be employed with a motivated patient who can be moved to a low caries risk behavior while employing methods to enhance remineralization. This medical approach calls for methods to monitor the lesion and its resolution.

Dentists have generally been trained toward surgical overtreatment of carious lesions. Even in moderate-to-low caries risk populations, dentists generally assume that lesions that are monitored are active and will progress. Recent clinical evidence suggests that this belief needs re-evaluation. In

* Corresponding author.

E-mail address: van.thompson@nyu.edu (V.P. Thompson).

a 2-year clinical study at the University of Michigan [7], invasive treatment (restoration) of moderate-to-small lesions was compared with observation of similar lesions. The investigators reported that the aggressive treatment approach (the clinical standard) led to overtreatment. Caries was arrested and not active in most cases in the observed patients. After 5 years, Hamilton and Dennison [8] confirmed in the observation treatment group that the number of previously established lesions progressing to treatment (restoration into dentin) was low. They emphasized that aggressive surgical management in this low-to-moderate caries risk population was unwarranted from a conservation of tooth structure perspective as well for economic reasons. In their study, subjects with five or fewer recent or new carious lesions were classified as low-to-moderate risk. This level of new lesions or recent restorations would place some of these patients in a high-risk classification according to the guidelines established at the authors' center (Tables 1 and 2).

Establishing caries risk

Critical to the management of caries is determining the caries risk of the patient. Patients at high or moderate risk should be guided to adopt methods and treatment to lower their risk. A quick risk assessment tool is provided in Table 2. This table takes into account patient behavioral factors, salivary factors, and iatrogenic concerns in addition to caries experience. Assignment of patients to a risk category based on this analysis is straightforward. A copy of this form can be supplied to the patient.

Critical to the establishment of risk is the ability to detect new or present carious lesions. In the era of fluoride, the signs of caries have been altered such that the surface enamel may exhibit little or no evidence of decalcification when observed clinically under moist conditions [9,10]. When saliva is quickly removed, underlying enamel shadowing may alert the clinician to the possibility of extensive underlying caries. In an earlier stage, even with dentin involvement, the caries often remains "hidden," sometimes referred to as "occult" caries. This phenomenon has been studied in Europe but not in the United States.

Caries has been reduced in the United States and other developed countries by a combination of patient awareness of good oral hygiene, the use of fluoride-containing dentifrices, and the addition of fluoride in drinking water [11,12]. Remineralization of carious lesion has been studied extensively in animal models [6]. The efficacy of these procedures is more pronounced for smooth surface caries than for pits and fissures. A significant level of caries remains in some socioeconomic groups. These groups include persons with poor dietary patterns, poor hygiene, or those taking medications that have the potential for causing xerostomia. As part of the diagnostic procedures employed in treatment planning, establishing

the risk for caries is a critical factor for dentate patients. Even within low-risk populations, there are significant findings of small or occult “hidden” caries [13,14]. In 15-year-olds, one study has found that 15% to 20% of teeth judged clinically to have sound molar occlusal surfaces can be shown radiographically to have evidence of dentinal caries [14]. This percentage increases to 38% and 50% in 17- and 20-year-olds, respectively [15].

In a more recent study [16], it was established that, for 17- and 20-year-olds, clinical examination alone grossly underestimated occlusal caries into dentin when compared with radiographic findings. Clinically, approximately 9% of molars were judged to have caries into dentin, whereas radiographic results found 27% involvement. The combination of clinical and radiographic observation indicated that 29% were carious, suggesting a lack of agreement. These findings verify earlier work in military recruits in which only one third of the lesions observed radiographically to extend into dentin were detected clinically [17]. This observation emphasizes the need to increase diagnostic skills to intercept this clinically hidden caries. Pitts [18] has developed the analogy of the iceberg of dental caries whereby many lesions are present but not visible or detectable by current means until the lesions are well advanced. All people are subjected to daily demineralization and remineralization events. Keeping the balance toward remineralization is the objective of nonsurgical management of the disease [19,20].

The caries balance concept must be communicated to patients. Table 3 lists selected Web- based resources that are available. The University of Malmo has a particularly attractive site that provides patients an excellent pie chart of the factors contributing to caries and caries risk. It is recommended that dentists make this chart available to patients to help them understand the nature of their “out of balance” dental disease.

Establishing the caries risk of an individual is a key aspect in diagnosis in caries management treatment planning [21,22]. The presence of one or more new lesions indicates a moderate-high caries risk. The evidence to support this finding for posterior proximal lesions has been confirmed in Swedish studies in children and young adults. The development of caries on the mesial surface of permanent first molars was 15 times more likely if the distal surface of the primary second molar was carious to the E2 level (inner half of enamel) and unrestored. This observation was reported in a population of children followed up radiographically from 6 to 12 years of age [23]. Restored surfaces did not lead to increases in the incidence of caries on the approximating surface.

The approximal caries experience at age 11 to 12 years is a good indicator of the likelihood of additional approximal lesions as indicated in a prospective study of 574 persons observed from 11 years of age to 22 to 23 years [24]. Individuals with no approximal caries developed these lesions at the rate of 17 per 100 person-years, whereas those with three or more lesions developed lesions at a rate of 91 per 100 person-years. This rate corresponds to individuals with no approximal lesions at baseline developing 3.1 new

Table 1
Guidelines for caries risk classification, treatment, and prevention

Component of care	Low-risk patients	Moderate-risk patients	High-risk patients
Clinical and radiographic findings and current medical history	No clinical caries No radiographic caries No recent restorations <1 y No recent changes in medical history	No more than two carious lesions present or No more than two recent restorations Recent change in medical history/ recent increase in risk factors	More than two carious lesions or More than two recent restorations Patient who is xerostomic Patient taking medications since last recall visit that cause dry mouth
Initial therapy	No recent new medications Review risk factors (diet, fluoride use, and medications) and oral hygiene	Review of risk factors and oral hygiene Immediately restore cavitated lesions Apply sealants to all at-risk molars and premolars Institute and monitor home care (see below)	Review risk factors and oral hygiene Immediately restore cavitated lesions using a defect-specific approach Apply sealants to all at-risk molars and premolars Institute and monitor home care (see below)
Home care protocols	Fluoride tooth paste, American Dental Association approved Oral hygiene flossing and brushing	Fluoride tooth paste, American Dental Association approved Oral hygiene flossing and brushing Fluoride rinse (ACT) or Fluorigard 2×/d as per directions	Prescribe PreviDent 5000 plus Oral hygiene flossing and brushing Advise the use of xylitol gum 3–5×/d, especially when unable to brush after meals or for patients who are xerostomic

Clinical re-evaluation	6 mo	4 mo	3 mo
Radiographic re-evaluation	24 mo, four bitewings with anterior periapicals as needed	12 mo, four bitewings with anterior periapicals as needed	6 mo, four bitewings with anterior periapicals as needed
In-office recall protocols	Re-evaluate for caries Review risk factors and oral hygiene	Review risk factors and oral hygiene	Review risk factors and oral hygiene
Change in risk group	If increases, follow appropriate protocol	If decreases, follow low-risk protocol If increases, follow high-risk protocol If stays the same for two consecutive recall appointments, move to high-risk group	If patient does not lower risk group within two recall appointments after having all active cavitated lesions restored, provide in-office application of fluoride at each appointment

Diagnostic techniques for caries: Visual inspection should occur after the teeth have been cleaned and then air dried for 5 sec. Tactile inspection should be performed to evaluate the activity of caries on easily accessible areas of teeth. An explorer should never be used to verify pit or fissure caries. Radiographic evaluation should include bitewings, only for posterior teeth, and periapicals, for anterior teeth, to determine the presence of interproximal decay but not to determine caries activity. For moderate- and high-risk patients, lesions that extend to D₁ or deeper should be surgically restored.

A person may be moved to a lower-risk category if, after all cavitated lesions have been treated, there are no new active caries for two consecutive recall visits. A person who is in the moderate-risk category and has not reduced his or her risk within 8 mo should now be considered high risk.

Table 2
Quick caries risk assessment chart

Caries risk factors			
Risk category	Risk factor	Yes	No
Caries activity	Cavitated lesions present (total no. of teeth:)	☐	☐
	Noncavitated active lesions (limited to enamel) (total no. of teeth:)	☐	☐
	Five or more restored surfaces (amalgams, composites, crowns)	☐	☐
	One or more missing teeth owing to caries	☐	☐
Fluoride exposure	No fluoride from water, tablets, drops	☐	☐
	No fluoride from toothpaste	☐	☐
Diet	Eats/snacks five or more times a day	☐	☐
	Daily pattern of sugar exposure (soft drinks, candy, medication)	☐	☐
Saliva quantity/quality	Diminished saliva (dysphagia, dry mouth, liquids to aid swallowing)	☐	☐
	Medication that reduces saliva secretion (http://www.lacledede.com)	☐	☐
Mechanical	Iatrogenic restorations promoting plaque retention	☐	☐
	Total risk factors—number of yes responses		
Patient's caries risk assessment			
Low risk		Moderate risk	High risk
☐	No active or recent (12 mo) caries and/or three or less risk factors	☐	Two or less current or recent caries and/or four or more risk factors
		☐	More than two current or recent caries and/or six or more risk factors
Patient who is xerostomic			

lesions per 100 tooth surface-years, whereas the corresponding value for those with three lesions at baseline is 7.7. The highest rate for new lesions was in the 11- to 13-year age period. If a lesion was present on the approximating surface that extended radiographically into dentin, a new lesion developing on the adjacent surface was 1.6 to 32 times more likely to occur [25]. Caries rates for the 24 posterior approximal surfaces ranged from 1.3 to 8.3 new caries lesions per 100 tooth surface-years.

The previous study was extended to the examination of a subgroup of 250 of the 536 individuals while 26 to 27 years of age [26]. The DFS (decayed and filled surfaces) of approximal surfaces was equivalent to the occlusal DFS, which was not true at the 11- to 13-year baseline, at which time the occlusal DFS was higher. New proximal caries was reduced to 2.7 per 100 surface-years for the 20- to 27-year period compared with 4.3 from 12 to 15 years of age.

Based on these caries progression studies, the caries risk classification of patients may be increased with the presence of existing proximal lesions or restorations, particularly in young teenagers. The studies suggest the need for interventions to determine the efficacy of methods to modify caries risk behaviors in these populations. Although several of the studies refer to the

Table 3
Notable caries assessment and management Web sites

Site	Items discussed	Web address
University of Michigan	Diagnosis and risk	http://oralhealth.dent.umich.edu/CDRAM/CariesHome.htm
	Surface-specific management recommendations	
University of Malmö	Risk definition for patients	http://www.db.od.mah.se/car/data/riskbasic.html
	Examples and links for patients	
University of California—Los Angeles	Caries as a disease for general review, particularly for patients	http://www.dent.ucla.edu/ce/caries/index.html
	General recommendations for treatment	
Federation Dentaire Internationale	Listing of reviews and their recommendations for management of caries	http://www.fdiworldental.org/resources/assets/guidelines/caries.html
Cochrane Reviews	Listing and abstract of systematic reviews in key oral health subjects	http://www.cochrane.org/cochrane/revabstr/ORALAbstractIndex.htm

caries experience in Europe, one should pay close attention to the findings. Cariology research has had a major emphasis over the last 20 years in European dental schools and in their public health programs. Unfortunately, other than programs at Indiana University, the University of Iowa, and only more recently at the University of California San Francisco (UCSF) and the University of Michigan, the United States has been lagging in caries research. The European caries studies, their observation of hidden caries, and the caries experience in predicting future lesions seem to correlate well to US populations, and an appreciation of their findings is important to the practice of dentistry.

Caries risk and salivary flow

Patients with diminished or compromised salivary flow are automatically classified as being at high risk for caries. A careful and regularly updated medical history is important to determine whether the patient is likely to have reduced saliva production. Most physicians fail to appreciate the dental consequences when the medications they prescribe have the potential for causing reduced salivary flow. A large percentage of medications have xerostomia as a side effect. A comprehensive list of these medications (more than 150) can be found at <http://www.laclede.com>. Patients should be questioned about any medications they are taking and whether they have experienced a reduction in their saliva. When applicable, they should be informed of the potential for xerostomic side effects. Fluoride rinses and the use of xylitol gums are recommended for these patients (see Table 1).

Stimulated and unstimulated salivary flow can be monitored in patients. Recently, a convenient kit has been introduced to check the patient's salivary condition (Saliva-Check [GC Corp., Alsip, Illinois]). This kit allows the dentist to determine easily the stimulated salivary flow of patients (gum and cup provided), the pH of the saliva (test strips provided), and the saliva buffering capacity (saliva-dispensing pipette and buffer test strip included). Detailed instructions are provided in the kit. The kit provides a useful demonstration tool to quantify the salivary flow. When it is found to be diminished because of disease or medications, the results can be a good motivator for improved home care.

Re-evaluation of caries risk

The caries risk should be re-evaluated and updated at each recall visit. The recall interval is highly dependent on the risk category of the patient. Low-risk patients can be placed on recall intervals as long as 1 year, whereas those at high risk are recommended to be recalled at 3-month intervals. The recall recommendations and the judicious use of bitewing radiographs are outlined in the guidelines for caries risk classification, treatment, and prevention listed in [Table 1](#).

The caries risk status of the patient should have a prominent place in the treatment record. The authors' center has developed a quick and easy way for any health care provider at the college to ensure that caries risk assessment is performed at the correct intervals. A self-inking stamp is placed into the progress section of the chart indicating the following:

Previous caries risk assessment (circle): Low Moderate High NA
Current caries risk assessment (circle): Low Moderate High
Discussed appropriate home care protocol with patient (check): ____
Date for reassessment: _____

A student circles the appropriate indicators and fills in the reassessment date. The stamp is used during the patient's initial visit and is repeated at the specified interval depending on the caries risk. This method allows for a quick and easy conformation of the prior status and a comparison with the current status. Patients must show a modified (lowered) caries risk for at least two consecutive office visits to be assigned a lower caries risk.

Caries detection and monitoring

Nyvad [27] has eloquently noted that "caries detection is not diagnosis." One must always consider the activity of the lesion and the caries risk status of the patient. The detection of early lesions that are near or just into dentin is now difficult in many patients. Visual methods for caries evaluation have changed as it has been recognized that the enamel must be dried properly to

permit early detection of the demineralization associated with caries. Enamel remineralization from the saliva is promoted by fluoride. In the presence of fluoride from dentifrices, water, and other sources, the surface enamel appears smooth and translucent; however, the underlying enamel beneath the occlusal surface and deeper within the occlusal fissure may be decalcified. This decalcification is not visible unless the enamel is dried for a sufficient period to remove the water from the involved porous enamel. A full 5 seconds of drying is required for the decalcification opacities to become visible beneath the more intact surface enamel. This decalcification is easily missed in a routine inspection involving removal of the gross saliva from the teeth with a light air blast.

The appreciation of the need to inspect for caries in the moist and dry state is the basis of newer visual caries diagnosis systems [28]. The latest method is the International Caries Diagnosis and Assessment System (ICDAS) that stems from a consortium of caries clinical researchers from around the world who are establishing validated methods for caries diagnosis involving visual methods and devices for the detection of caries [29]. Although this system is still in the process of validation, the need for thorough drying of teeth for the detection of noncavitated (frank) lesions is a cornerstone of the assessment system and its forerunners. The ICDAS system is intended to allow lesions to be evaluated visually as to whether they are active or arrested [30]. Properly dried active lesions have a dull or matt surface appearance. Properly dried nonactive lesions have a smooth glossy surface.

Emerging technologies for monitoring noncavitated carious lesions

Laser fluorescence has been introduced to aid in the detection and monitoring of occlusal caries. The Diagnodent device (KaVo, Lake Zurich, Illinois; http://www.kavo.com/En/produkte/therapie_instrumente/prophylaxe/diagnodent/diagnodent.asp?navid=40&lan=En) is a relatively new method (available for approximately 4 years in the United States) for caries detection. It employs a laser system to illuminate the dentin locally through the enamel in pits and fissures. The laser beam is used like a flashlight to illuminate the bacterial metabolites (porphyrins) that are present in the dentin and that fluoresce. The fluorescence is picked up by the Diagnodent probe and recorded as a reading that is compared with that of sound tooth structure on the same tooth. The reading is displayed as a numerical value. At a critical value, an audible tone is emitted. The Diagnodent device has been evaluated in a range of clinical studies and is accepted as an aid in caries detection with some limitations [31–34].

Visual and Diagnodent findings are compromised in stained pits and fissures and may give false high readings; therefore, a definitive diagnosis requires clean teeth. KaVo markets the Diagnodent device with its Prophy Jet, which uses carbonate particles to abrade/clean the tooth pits and

fissures before taking the Diagnodent readings. Diagnodent readings are also high in the presence of green stains and in tea drinkers (porphyrins from the tea and chlorophylls from the greens) [35]. Diagnodent readings have limitations because they only quantify areas of decalcification, and because a large shallow area immediately below a pit and fissure may produce a high value [35,36]. These findings should not be confused as an indication of the depth of a lesion. Even with this limitation, an experienced user will find Diagnodent readings to be a valuable adjunct to visual and radiographic findings. The Diagnodent is especially valuable in monitoring lesion progression, stasis, or reversal, because the reproducibility of the readings is good [37–39]. The Diagnodent has also been validated for occlusal caries detection in children [40].

Although the diagnosis of occult dental caries may be enhanced by detection devices such as the Diagnodent, a combination of visual-tactile examination and conventional or digital radiography was found to identify more than 80% of lesions if they were sufficiently advanced [41]. Extracted premolars ($n = 320$) thought to be caries free were examined. Nineteen percent of the teeth had radiographic evidence of caries in dentin (hidden or occult caries). These lesions were candidates for surgical treatment.

Additional methods of caries detection and monitoring are now becoming available. The Diagnodent Pen (KaVo) is an improved version of the Diagnodent. The Pen provides improved tips (less prone to breakage) and a new small tip intended for the detection of interproximal caries. A better digital display and audible caries indicator are included. Whether this device has an expanded range of values for caries is not known. The current Diagnodent device is limited because the diagnostic information is primarily in the 0 to 30 range of a 0 to 100 scale. The Diagnodent has a high but limited specificity (indicating that caries is present in instances when it is not) [35,42]. Research is ongoing in ultrasonic methods to image decalcification in teeth, but no device has been tested in clinical trials at this time.

Other devices requiring additional clinical studies to establish their sensitivity and specificity for early caries detection and monitoring include quantitative laser-induced fluorescence (QLF) (<http://www.inspektor.nl/dental/qlfmain.htm>) and digital fiberoptic inspection (DiFoti) (<http://www.difoti.com>). Both of these systems have their advocates; however, based on their high cost and limited use for the detection of occlusal lesions, particularly in molars, they have not yet proved to be cost effective. The quantitative laser fluorescence device is the new standard for the detection of demineralization/remineralization in the surface of enamel (white spot lesions) in dentifrice efficacy studies.

A careful clinical examination supplemented with Diagnodent readings and periodic radiographics is currently the standard for caries detection and the monitoring of existing lesion progression or resolution.

Medical caries management: Caries Assessment and Management By Risk Analysis and the New York University College of Dentistry approach

Approaches for the medical management of caries have been proposed [43] but are not based on the latest clinical evidence. In an attempt to address this need, the Caries Assessment and Management By Risk Analysis (CAMBRA) method has been developed by a group of seven West Coast dental schools spear headed by the Restorative Dentistry Department at the USCF and its most recent chairperson, John Featherstone [44] (see Table 3 for the Web site). The underlying assumption of CAMBRA and all other caries management programs is that caries risk can be established and monitored for patients. This task requires combining clinical, radiographic, and other diagnostic findings with the medical history. Clinical examination requires a careful inspection of the teeth with an emphasis on properly dried occlusal surfaces. This examination is supplemented by devices such as the Diagnodent, which can aid in detection when caries is suspected and not progressed to the point of radiographic determination. Pit and fissure caries must extend into 2 to 3 mm of dentin and more than 30% of the buccal lingual width for reliable (high sensitivity and specificity) radiographic detection [45]. In the CAMBRA approach, the patient is educated and then involved in a partnership to lower his or her caries risk and to manage the disease with a combination of chlorhexidine mouth rinses, fluoride treatments, and lower-risk behaviors (see Table 3). The treatment recommendation is to use a chlorhexidine rinse (0.1%) once a day for 1 week each month along with daily use of a high-fluoride dentifrice (eg, PreviDent 5000). The chlorhexidine is purported to cause a reduction in *Streptococcus mutans* and lactobacilli counts over a 3- to 6-month interval. Although chlorhexidine may have caries preventive attributes [46]), it is apparently less effective in the reduction of *S mutans* levels, at least in children, than a combination of fluoride rinse and xylitol gum [47]. Whether the combination of fluoride with xylitol or each alone might be effective was not determined in this study. Chlorhexidine was not effective in reducing caries transmission to children with their mother's use of this antimicrobial treatment [48].

It is necessary to clarify the use of fluoride and other measures regarding their efficacy as preventive agents versus therapeutic agents. Preventive agents do not allow a disease or condition to become manifest, whereas therapeutic agents promote the reversal or elimination of the condition. Fluoride rinses seems to be more efficacious with regard to the latter as shown in studies of reversal of proximal lesions [49]. Fluoride has more recently been shown to reverse existing occlusal lesions in a 4-year caries study in children [50]. When compared with chlorhexidine, a fluoride rinse was decidedly more effective in the reversal of root caries in elderly patients in health care facilities [51]. An excellent review of the current literature related to chlorhexidine, particularly as a varnish, suggests that it is only

validated for the prevention of occlusal caries in populations with low or no exposure to fluoride [52]. The decision to not use chlorhexidine in the management of caries at the authors' center is predicated on these observations while awaiting the outcomes of the CAMBRA approach at the UCSF.

The authors' recommendation for aggressive nonsurgical management of noncavitated carious lesions involves fluoride, xylitol gum, and the lowering of risk behaviors as shown in Table 1. Individuals who have a high caries risk require aggressive fluoride treatment based on the use of a 5000 ppm fluoride dentifrice (eg, PreviDent 5000) before bedtime. The patient is requested not to rinse following brushing or to keep rinsing to a minimum. The "spit don't rinse" procedure is advocated. A xylitol gum (eg, Carefree Koolerez, which comes in a range of flavors, ClenDent, CareFree, Trident, Wrigley's Extra) is also prescribed. Inspection of the gum ingredients on the package should list xylitol first as the major component. The recommendation is to chew one or two sticks of the gum three to five times per day, particularly after meals or snacks. The gum stimulates salivary flow with its buffering and dilution effects. In addition, the xylitol is not metabolized by cariogenic bacteria and is proposed to shift the bacterial (*S mutans*) populations toward noncariogenic strains. Recent laboratory work suggests that xylitol may have a role in promoting remineralization deep in demineralized enamel [53]. Xylitol gum has been adopted by the US Army for inclusion in the "meals ready to eat" supplied to its combat troops. This practice is based in part on the stated preventive efficacy of xylitol in the 2001 report of the National Institutes of Health Consensus Development Conference on Diagnosis and Management of Dental Caries Throughout Life.

Caufield [3] has provided a provocative review of caries as an infectious disease and the proposed treatment. Specifically, he notes that antimicrobial approaches to control caries are likely to fail based on the need for noncariogenic bacteria to help police the dentition and limit opportunistic pathogenic organisms. He notes that 80% of new caries is associated with pits and fissures. This "ecologic niche" for pathogenic organisms that develop in nondisturbed biofilms is augmented by other niches such as faulty or leaking restorations and advanced white spot lesions. Antimicrobial treatment and fluoride more readily affect surface biofilms and cannot easily diffuse into the thick mature biofilms at these sites. Only through modification or removal of these sites will significant levels of cariogenic organisms be removed. Modification might involve, based on the caries risk, the extensive use of bonded sealants to seal grooves and fissures, the sealing of margins of existing restorations, and the restoration of advanced lesions. In the last instance, following the completion of the restoration, it and the associated grooves and fissures should be sealed. Although this approach is appealing, the results of clinical studies are needed to provide evidence of its efficacy before adoption of this intensive approach.

Patient communication

Patient commitment is a key factor in the success of medical caries management programs. The dentist and his or her staff should develop a communications device so that patients have a record of the caries findings and the proposed management plan. A paper record of the number of incipient lesions and those to be surgically treated is helpful. Furthermore, patients should be informed of the need to present this information to another dentist if they choose to obtain a second opinion. This approach will help to distinguish the dental practice from others that employ a primarily surgical approach. Many patients will appreciate the use of medical treatment as opposed to restoration of all detected lesions.

Establishing and communicating the risk for caries creates an informed patient. The risk category is included in the treatment plan information and should be updated at each patient visit. At the treatment plan appointment, patients should sign the chart to acknowledge their caries risk status and the fact that they have been informed as to how to modify their behavior. If a high-fluoride dentifrice is prescribed, it is of course noted in the chart. Patients are also routinely apprised that insurance will only pay for a portion of the cost of the regular diagnosis of these incipient lesions because, if they are in a high-risk category, their recalls may be at 3- or 4-month intervals. An interesting practice management approach to improve compliance is to dispense prescription medications in sufficient quantities such that patients will need to return for their recall appointment when the medication needs to be refilled.

Ozone treatment for medical management of caries

Recently, ozone treatment has been proposed as a treatment for caries. The instrumentation is described by the manufacturer (http://www.kavo.com/En/produkte/therapie_instrumente/healozone/healozone.asp?navid=26&lan=En). To date, ozone treatment has been shown to kill effectively the bacteria associated with these lesions [54] and can lead to lesion reversal as measured by hardening of the involved root surface in a clinical study [55].

The device is well designed and is intended to be used to kill bacteria with a flow of ozone delivered to the tooth surface for 10 to 40 seconds depending on the depth of the lesion. There is little doubt that the ozone delivered kills all of the bacteria in the lesion biofilm. Ozone treatment is then followed by patient use of remineralizing solutions and fluoride rinses. Should the patient not follow this regimen, the carious process can be expected to be re-established unless a sealant or restoration is placed. Some dentists suggest that the patient return on a periodic basis for ozone retreatment. A Web search under the keyword “HealOzone” will lead to many dentist sites outside the United States, because the treatment is only available in the

European Union and the United Kingdom (including Canada). Currently, the HealOzone device is undergoing clinical trials at three US dental colleges for Food and Drug Administration submission documentation.

Although several abstracts have been published on ozone treatment of occlusal caries, there is no peer-reviewed publication on this use. Recent reviews of ozone treatment of caries suggest that it may be efficacious, but further clinical evidence as to its usefulness is needed [56,57]. A review of the medical use of ozone recommends its application when conventional treatments are ineffective but warns against its use in too high a concentration [58].

Summary

The treatment of noncavitated caries requires that one consider the lesion, its depth, and its activity, as well as the caries risk classification of the patient [27]. Traditionally, dentists have been trained in the surgical model for caries management in which detection is akin to diagnosis, and this model has unfortunately been translated to patient expectations. A growing body of clinical evidence suggests that noncavitated lesions, even those extending into dentin, can be managed by nonsurgical means with an expectation for remineralization. The question that remains to be answered for most dentists is whether a clinically or radiographically detectable lesion will progress. If patients can collaborate with the dentist and his or her staff to acquire and maintain a low-caries risk behavior, a growing body of evidence suggests that the bacteria responsible for caries will be at such a low level, even in pits and fissures, that the caries will not progress. The remineralization process will predominate in all of these ecologic niche areas for caries-forming bacteria, which are present in every dentate individual.

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