

CAMBRA: From Research to Practice

Learning Outcomes

- Explain the science behind the initiation and progression of the dental caries disease process
- List and discuss the various factors in the caries balance model
- Describe the principles of clinical intervention in the caries process
- Explain the team approach in integrating CAMBRA into an oral healthcare practice
- Describe motivational strategies to assist the entire dental team with understanding and embracing the CAMBRA protocol

Introduction

For most of the 20th century, dental caries and periodontal diseases were prevalent in the United States and many other countries worldwide. Our understanding of these diseases, their etiology and pathogenesis, was limited and dental practice consisted primarily of diagnosing and repairing the consequences of these diseases. Today, the level of knowledge regarding the process of dental disease has increased substantially. Additionally, medical and dental science now recommends that health care providers identify and treat patients based on their risk status, rather than administering the same treatment to all patients. As a result, the management of dental disease is transitioning from a surgical repair model to a wellness model of care.

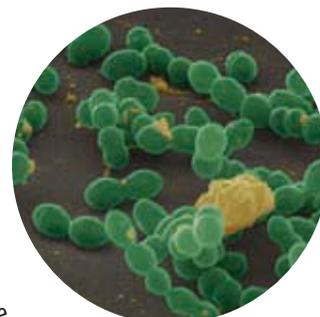
Risk assessment is an estimation of the likelihood that a specific event will occur in the future. With respect to dental caries, management by risk assessment is based on the understanding that the disease is initiated by a complex biofilm, rather than any one pathogen, and that it may vary significantly from patient to patient. Moreover, this biofilm changes radically based on its environment and the local chemistry of the tooth site, pellicle, and saliva with which it comes into contact. Other important factors also require consideration. To help guide the clinician in assessing a patient's risk for developing carious lesions, a variety of approaches have been developed for application in everyday dental practices. Featherstone and colleagues developed a risk assessment tool, caries management by risk assessment (CAMBRA), which includes the use of

historical and environmental factors and employs technology to evaluate bacterial presence, salivary flow rate, and dietary patterns. This article describes the implementation of the risk assessment concept, specifically CAMBRA, into a standard dental practice for effective and efficient use.

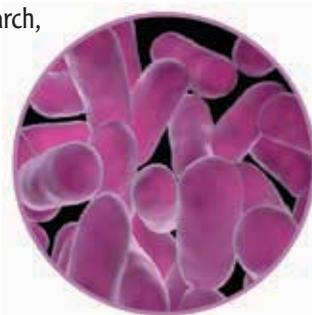
Review of the Dental Caries Disease Process

Demineralization

Dental caries is a transmissible and multifactorial disease process. The mechanism that initiates the caries process is microbial, the primary causative agents being mutans streptococci (which includes *Streptococcus mutans* and *Streptococcus sobrinus*) and lactobacilli, which live in the biofilm attached to teeth.¹ These pathogens metabolize fermentable carbohydrates--sucrose, fructose, glucose, and cooked starch, to produce organic acids that rapidly change the environment of the biofilm or plaque from a typical (resting) neutral pH to an acidic one.² The acids diffuse through the plaque into the enamel rods composed of crystals surrounded by pores and diffusion channels. These channels, filled with proteins, lipids and water, allow the passage of organic acids, ions, hydrogen, calcium, phosphate, and fluoride to flow within them.^{2,3} The acids then disassociate producing the hydrogen ions that begin to dissolve and remove minerals from the porous subsurface enamel and exposed dentin. Calcium and phosphate ions are forced out into solution, which in turn diffuses out of the tooth leading to demineralization.³



Streptococcus mutans



Lactobacilli

Remineralization

Remineralization can occur after the ingestion of fermentable carbohydrates stops and the pH gradually returns to neutral, usually taking about 30 to 60 minutes, provided adequate saliva is present. Saliva's role is crucial. Its components neutralize acids and raise the pH, reversing the diffusion gradient for the calcium and phosphate ions and providing additional minerals for reconstruction. Saliva is naturally supersaturated with calcium and phosphate, necessary components

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for remineralization. Diffusion drives these minerals back into the partially demineralized crystal remnants within the lesion.³⁻⁴ These remnants act as “nucleators” for new surfaces to form on the crystals. The proteins in saliva help maintain the super-saturation of calcium in the plaque fluid, while other proteins and salivary components form a protective pellicle on the tooth surface and still others have antibacterial and antifungal properties. Saliva also contains immunoglobulins, buffers and minerals including bicarbonate and naturally-occurring amounts of fluoride.³⁻⁴

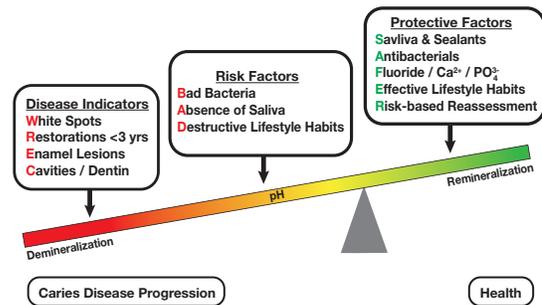
Whether an initial carious lesion progresses into a hole (or cavitation) or is able to remineralize depends on a number of factors. Importantly, there must be sufficient saliva containing the minerals necessary to repair, strengthen, and provide support for rebuilding the enamel and subsurface. If the salivary flow is low, hyposalivation, and the acidogenic bacterial load is high, or the frequency of fermentable carbohydrate ingestion is excessive, the repair process will be too great for naturally-occurring salivary remineralization.⁵ These conditions can initiate a carious lesion clinically known as a “white spot” which indicates a loss of calcium and phosphate minerals in the subsurface zone in the presence of an intact enamel surface. White spot lesions are partially reversible provided the surface remains intact and a topical fluoride agent is directly applied.^{3,5-6}

Fluoride can enhance or accelerate remineralization of the partially demineralized surfaces of crystal remnants inside a carious lesion by adsorbing to the affected crystal surface. The negatively charged fluoride ions (F⁻) attract calcium ions (Ca⁺), followed by phosphate ions (PO₄⁻).^{3,7-9} This leads to formation of a new crystal surface, stronger and less soluble than the carbonated hydroxyapatite mineral first laid down during tooth development, which is softer and more susceptible to acid attack.^{3,7-9} The newly formed crystal surface excludes carbonate (CO₃⁻) ions during construction and the result is a composition with solubility somewhere between that of hydroxyapatite and fluorapatite.³ This newly remineralized fluorapatite-like surface has very low solubility, and future acid attacks would have to be substantial and prolonged in order to have a damaging effect.

CAMBRA and the Caries Balance Scale

The fundamental concepts used in the CAMBRA method of risk assessment can be illustrated using a balance scale.^{3,5} The general indicators and factors assessed are identified and grouped in three risk-related categories: disease indicators, risk factors, and protective factors. The balance mechanism and the placement of the subcategories on the scale reflect the nature and relative weight

The Caries Balance / Imbalance



of the factors. Simply stated, if the protective factors outweigh the risk factors and disease indicators, it can be generally concluded that the patient has a low risk for future caries and that the process of remineralization will outweigh the progression of disease. The opposite conclusion could be reached if the disease and risk factors either outweigh or are judged equivalent to the protective factors, revealing a patient who is at high risk for demineralization and carious lesions the future.

Disease Indicators

The caries disease indicators are four observations obtained from a clinical examination of the patient that provide information about the caries history and activity.

- Visible white spots on smooth enamel surfaces
- Restorations placed within the previous three years
- Approximal radiographic lesions confined to the enamel
- Teeth with frank cavitations or radiographic lesions showing penetration into the dentin.⁵

These observations are indicators that there may be disease present or that disease has taken place recently. It is important to remember that these indicators provide no causative factors and offer no treatment options. Rather, they describe clinical observations which, when taken together, strongly suggest that unless a nonsurgical, chemical treatment occurs, the disease process will continue. A positive finding in any one of the four disease indicators places the patient in the **high risk category** unless chemical intervention is already underway. A bacterial culture is strongly recommended in these individuals.

Caries Risk Factors

Caries risk factors are biologic indicators contributing to the patient’s level of risk for developing carious lesions in the future and for the progression of existing lesions. They not only reveal what circumstances and conditions are out of balance but at the

same time, also indicate what areas need to be addressed to correct the situation. The three risk group factors are:

- Bad Bacteria
- Absence of Saliva
- Destructive Lifestyle Habits⁵

These groups represent the presence of acidogenic bacteria in the biofilm, inadequate salivary flow, and the number or type of destructive personal habits of the patient, all of which are inter-related to the caries disease process as well as to each other.

The first risk factor, “bad bacteria,” represents the effusive acid producers that initiate demineralization as discussed earlier. Moreover, the metabolism of sucrose by mutans streptococci creates a sticky substance called glucan, which facilitates the adherence of additional pathogenic bacteria to tooth surfaces.¹⁰⁻¹¹ Interestingly, glucan can be stored intracellularly by some bacteria to provide energy in times of sugar shortage. This allows continual acid production over extended periods of time and maintains a lowered pH in the plaque.¹⁰⁻¹¹

The second factor, “absence of saliva,” not only plays a crucial role in remineralization and protection of the dentition, but an adequate salivary flow is also necessary to cleanse tooth surfaces, facilitate clearance of food particles, and prevent retention of sticky carbohydrates on and around the teeth.⁴ It follows that the absence of saliva facilitates plaque buildup, and the salivary components

that provide the various protective functions are not present in sufficient quantities to be effective.^{3,4}

The third factor, “destructive lifestyle habits,” includes poor diet, the amount and frequency of fermentable carbohydrates is a key issue, recreational drug use and, poor oral hygiene to name a few.⁵ In the absence of disease indicators, the patient’s caries risk status is determined by the balance between these pathologic risk factors and the protective factors discussed next.

Caries Risk Factors^{5,12}

- Medium or high mutans streptococci and/or lactobacilli counts
- Visible heavy plaque/biofilm
- Snacking between meals, more than 3x day
- Deep pits and fissures
- Recreational drug use
- Inadequate salivary flow
- Saliva reducing factors: medication, radiation therapy, systemic conditions, disease, genetic
- Exposed root surfaces
- Orthodontic appliances

Caries Protective Factors

The caries protective factors are biologic and therapeutic measures or conditions that can collectively offset the challenges presented by the caries risk factors. As in the nature of a balance scale, the number of protective factors needed to outweigh the risk factors for demineralization and disease progression will depend on the number and severity of the risk factors. Increased protective factors should adjust the patient’s risk toward a positive balance leading to remineralization, and reversal of any existing caries process.^{12,13} Currently, there are eleven protective factors for reducing caries risk. An individual’s overall caries risk is calculated by comparing the number of risk factors to the protective factors.

The Key Role of Fluoride

Fluoride is the one of the most effective caries prevention agents currently available. In addition to preventing demineralization and promoting remineralization, fluoride also inhibits bacterial growth provided that there are sufficient F⁻ ions present in the saliva. This can be achieved by using 5000 ppm toothpaste, applications of fluoride varnish, and/or use of trays and 5000 ppm fluoride gel.^{5,8-9,12} Fluoride’s bactericidal action takes place when the F⁻ ions combine with the positive hydrogen (H⁺) ions that have been produced by the bacterial plaque. The formation of hydrofluoric acid (HF) takes place when the pH in the plaque decreases as the bacteria produce an acidic environment, or H⁺ ions. The HF acid is then able to rapidly diffuse through the cell wall.^{3,5,12} Once inside the cell, additional HF ions are drawn inwards. The intracellular HF then disassociates again into H⁺ and F⁻, acidifying the cell and

Caries Protective Factors^{5,12}

- Live, work, attend school in a fluoridated community
- OTC fluoride used at least 1x/day
- OTC fluoride used at least 2x or more/day
- Daily fluoride mouth rinse (Rx or OTC)
- Rx fluoride toothpaste (5000 ppm) used at least 1x/day
- Fluoride varnish applied in the past 6 months
- Professionally applied topical fluoride in the past 6 months
- Chlorhexidine rinse used daily for 1 week/month for the past 6 months
- Xylitol gum or lozenges (minimum 6 grams) used 4-5x daily in the past 6 months
- Calcium and phosphate supplement paste used during the past 6 months
- Adequate salivary flow, more than 1 ml per minute after stimulation

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releasing fluoride ions which interfere with essential intracellular enzyme activities and causes apoptosis or cell death.^{3,5,12}

It is also important to differentiate between the topical and the systemic effect of fluoride on enamel solubility. Sound enamel, generally contains fluoride at levels of approximately 20-100 ppm, depending on the fluoride ingestion that occurred during tooth development. Children who have been exposed to fluoridated drinking water may have a fluoride content toward the high end of this range.^{5,12} Yet fluoride incorporated during tooth development at the average levels of 20-100 ppm does not measurably alter the acid solubility of the mineral. However, topical applications which add as little as 1 ppm of fluoride to the acidic solution surrounding the enamel crystals, reduces the dissolution rate to that of fluorapatite and additional increases in fluoride will decrease the solubility rate logarithmically. Still, sufficient fluoride must be present and incorporated into a new crystal surface at the time of the remineralization process to beneficially alter enamel solubility. If fluoride is present in the plaque fluid at the time the bacteria generate acids, it will not only lay the foundation for calcium and phosphate ions to begin remineralization but travel with the acid into the subsurface enamel and adsorb to the crystal, providing some protection from dissolution.⁸⁻⁹ Regular exposure to fluoride is needed for good oral health throughout the lifespan.

Translating CAMBRA Science into Practice

CAMBRA is essentially a philosophy of care that can be adopted by an individual dental practice as a value-added service with mutual benefits for patients as well as the practice. The science behind CAMBRA was first introduced in 2003. Following its introduction, a consensus statement from national experts was developed along with CAMBRA guidelines and a suggested caries risk assessment (CRA) form.¹⁴ See Table 1 for CAMBRA guidelines developed for patients 6 years and older.

Commitment of the Dental Team to CAMBRA

CAMBRA begins with the dentist's willingness to make the paradigm shift from surgically treating teeth to incorporating a chemical mode of therapy into the patient's treatment plan. Recent outcomes from the UCSF CAMBRA study revealed a 20% reduction in new caries over time when practitioners used CAMBRA protocols.^{5,12,15} These study results, in conjunction with the American Dental Association's (ADA) evidence-based dentistry recommendations, support the implementation of CAMBRA into mainstream clinical practice for the reduction of new carious lesions.¹⁶ Dental hygienists, most often considered to be the prevention specialists in dentistry, are ideally positioned to take a leading role in the implementation process.

Table 1: CAMBRA Clinical Guidelines for Patients 6 years and older¹⁴

Risk Level	Radiographs	Caries Risk Evaluation	Saliva Tests (flow and culture)	Antibacterials Chlorhexidene Xylitol	Fluoride	pH Control	Calcium Phosphate Supplements	Sealants
Low	Bite-wings every 24 -36 months	Re-evaluate every 6-12 months	Baseline reference for new patients	Per bacterial culture	OTC fluoride toothpaste 2x day	Not required	Not required	Optional or per ICDAS protocol*
Moderate	Bite-wings every 18-24 months	Re-evaluate every 6-12 months	Baseline reference for new patients or if a high bacterial challenge is suspected	Per bacterial culture Xylitol gum or candies (6 -10 grams/day)	OTC fluoride toothpaste 2x day .05% NaF OTC rinse daily NaF varnish	Not required	Not required	As per ICDAS protocol
High**	Bite-wings every 6-18 months until no new cavitated lesions present	Re-evaluate every 3-4 months	Flow and culture at initial exam and every caries risk evaluation	Chlorhexidene gluconate 0.12% rinse 10ml 1 minute/day for 1 week/month Xylitol gum or candies (6 -10 grams/day)	1.1% NaF Rx toothpaste .2% NaF Rx rinse Fluoride varnish every 3-4 months	Not required	Calcium phosphate paste used several times/day	As per ICDAS protocol
Extreme***	Bite-wings every 6 months until no new cavitated lesions present	Re-evaluate every 3-4 months	Flow and culture at initial exam and every caries risk evaluation	Chlorhexidene gluconate 0.12% rinse 10ml 1 minute/day for 1 week/month Xylitol gum or candies (6 -10 grams/day)	1.1% NaF prescription toothpaste .2% NaF rinse Fluoride varnish every 3-4 months	2 tsp baking soda per 8oz water after meals Baking soda gum as needed	Calcium phosphate paste used several times/day	As per ICDAS protocol
* International Caries Detection and Assessment System ** One or more cavitated lesions *** One or more cavitated lesions with xerostomia								

Review of the Guidelines

The dentist(s) and hygienists(s) must first review the CAMBRA protocols or guidelines (Table 1) and select an appropriate CRA form. While there are many CRA forms available on the market, such as the one adapted by the school of dentistry at the University of California, San Francisco (UCSF) shown in Table 2, dental practices may choose to create their own CRA form to meet their unique practice needs.⁵ Increased knowledge of the scientific basis underlying the CAMBRA philosophy along with the real world clinical patient outcomes may lead to ongoing refinements of the chosen CRA form.

Increased knowledge of the science underlying the CAMBRA philosophy and/or the clinical outcomes of the patients may require development and customization of a caries risk assessment form to suit the specific needs of the practice. Refinements to the form and implementation process can be made once the practice initiates CAMBRA.

Incorporating CAMBRA into Clinical Practice

Once a framework for implementing CAMBRA has been established, the practice can begin using CRA and the selected form, to determine the patient's caries risk. The dental hygiene process of care provides an excellent framework for implementation and evaluation of the CAMBRA protocol.

The Dental Hygiene Process of Care⁶

- Assessments
- Diagnosis
- Planning
- Implementation
- Evaluation
- Documentation

Data required to complete the CRA form can be gathered during the initial dental examination or during a dental hygiene care appointment. For existing patients, the hygienist may transfer data from the patient's chart to a caries risk assessment form when reviewing charts at

the beginning of the day. Medications with known oral side effects or health conditions impacting the patient's ability to perform effective home care can be noted in advance for discussion with the patient. Information concerning additional caries risk factors can be obtained by reviewing the patient's periodontal chart to note areas of recession and review previous oral hygiene instructions. The clinician should also review the dental charting, radiographs and treatment notes for disease indicators.

Table 2: UCSF CRA form

UCSF 2013 modified version of Caries Risk Assessment Form from CDA Journal October 2007			
Caries Risk Assessment Form for Ages 6 Years Through Adult			
Patient Name: _____		CHART #: _____	DATE: _____
Assessment Date: _____		Is This (please circle) Baseline or Recall	
Disease Indicators (clinical observations indicating the presence of dental caries disease)	Yes = Circle	Yes = Circle	Yes = Circle
Cavities/radiograph to dentin	<input checked="" type="radio"/>		
Approximal enamel lesions (E1, E2) (by radiograph)	Yes		
White spots on smooth surfaces (Eo)	Yes		
Restorations a) last 3 years for new patient	Yes		
b) last 12 months for patient of record	Yes		
Risk Factors (Biological predisposing factors)		Yes	
MS and LB both medium or high (by culture** or ATP test greater than 4,000 - record actual reading)		Yes	
Visible heavy plaque on teeth		Yes	
Frequent snacking(> 3x daily between meals)		Yes	
Deep pits and fissures		Yes	
Recreational drug use		Yes	
Inadequate saliva flow by observation or measurement (* **If measured note the flow rate below)		<input checked="" type="radio"/>	
Saliva reducing factors (medications/radiation/systemic)		Yes	
Exposed roots		<input checked="" type="radio"/>	
Orthodontic appliances		Yes	
Protective Factors			
Lives/work/school fluoridated community			<input checked="" type="radio"/>
Fluoride toothpaste at least once daily			<input checked="" type="radio"/>
Fluoride toothpaste at least 2x daily			<input checked="" type="radio"/>
5000 ppm F fluoride toothpaste daily			Yes
Fluoride mouthrinse (0.05% NaF) daily			Yes
Fluoride varnish in last 6 months			Yes
Office F topical in last 6 months			Yes
Chlorhexidine prescribed/used one week each of last 6 months			Yes
Xylitol gum/lozenges 4x daily last 6 months			Yes
Calcium and phosphate paste during last 6 months			Yes
Adequate saliva flow (> 1 ml/min stimulated)			Yes
**Bacteria/Saliva Test Results: MS: 6 LB: or 5 ATP test: Saliva Flow Rate: 0.7-1.6 ml/min. Date: _____			
VISUALIZE CARIES BALANCE (Use circled indicators/factors above) (EXTREME RISK= HIGH RISK+ SEVERE XEROSTOMIA) CARIES RISK ASSESSMENT (CIRCLE): EXTREME <input checked="" type="radio"/> HIGH MODERATE LOW Doctor Signature/#: _____ Date: _____			

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The Patient Interview

CAMBRA protocols may be introduced during the health history interview as part of the general assessment process for health promotion and disease prevention. Information relating to diet, snack and beverage choices, and destructive social behaviors should be obtained at this time. Using open-ended questions allows the clinician to build trust and rapport while providing an opportunity to ascertain the patient's interest in improving their oral health status.

Intraoral Examination

The intraoral examination provides opportunity for the clinician to gather data relevant to caries disease indicators and risk factors, and document their findings on the CRA form. This is also a good time to determine the



Adult dentition following the application of disclosing solution.

salivary flow rate. The saliva sample may also be used to culture for *streptococcus mutans* and *lactobacillus*. Disclosing the teeth at the beginning of the dental hygiene care appointment is an excellent educational tool in addition to providing a visual confirmation of the plaque index. A photograph of the disclosed teeth is also valuable as a benchmark for future comparisons of the patient's progress. Initial assessments should also include the location and severity of decalcified areas, as well as any potential carious lesions.

Diagnosis

Once the assessments are complete, the clinician should determine the patient's caries risk level based on the evidence and their clinical judgement. Although the saliva culture results will not be available at the time of the initial exam, there should still be sufficient data to determine the caries risk level.

Planning and Implementation

Once the CRA form is complete and the caries risk level determined (as shown in Table 2), the various treatment recommendations can be presented. At this point, the clinician would refer back to the CAMBRA guidelines (as shown in Table 1) to establish the product regimen, continuing care interval, and radiograph frequency that best meets the needs of the patient. As the dental practice becomes more proficient using the CAMBRA protocols, they will become as integrated into the practice's standard of care as taking a medical history or completing periodontal assessments. A sample treatment plan for a high caries risk patient is described in Table 3.

Table 3: Treatment Plan for a High Risk Caries Patient

- **Oral hygiene instruction** emphasizing mechanical biofilm displacement
- **Rx fluoride toothpaste (5000ppm) 2x day**
 - Avoid rinsing following application for maximum benefit
- **Chlorhexidine rinse for 1 minute daily for 1 week each month**
 - Separate rinsing and the application of Rx fluoride toothpaste by at least 60 minutes due to the positive charge of the chlorhexidine and the negative charge of the fluoride ions
 - Monthly reminders for rinsing may be sent via text or email
- **Gum or candies sweetened with xylitol (6-10 grams/day)**
- **Additional use of a calcium phosphate paste** for enhanced re-mineralization and xerostomia relief
- **3-4 month dental hygiene care interval**
- **Fluoride varnish application** at each dental hygiene care appointment
- **Annual bite-wing radiographs**

Table 4: Continuing Care for the High Caries Risk Patient:

- Review health history; noting medications with oral side effects
- Review the caries risk level
- Re-score and compare plaque index scores
- Review oral hygiene instructions; note what works and what does not
- Record any changes in the sites being monitored
- Review use of dispensed products
 - Rx fluoride toothpaste
 - Chlorhexidine rinse 1x week/monthly
 - Xylitol products
 - Calcium phosphate paste
- Consider any needs for treatment modification, dental hygiene care interval, or frequency of radiographs

Evaluation

Re-evaluation of caries risk should take place at each successive dental hygiene care appointment. Similar to the periodontal evaluation, CAMBRA provides the dental hygienist with a formal framework for documenting and evaluating a patient's dental caries risk and opens the door for positive reinforcement of oral hygiene habits and continuing patient education. It also provides an opportunity to evaluate and adjust the patient's oral health care program. While many of these procedures are probably already in place as part of a dental hygiene care appointment, specifically including CAMBRA as part of the dental practice's standard of care enables the hygienist to address caries risk in the overall framework of health promotion and disease prevention.

Documentation

Regardless of whether the practice uses paper or electronic charting, the risk assessment form documenting the patient's caries risk, recommended treatment, sites to be monitored, and oral care products dispensed must be included in the patient's record. Color coded forms are easily identified if paper charts are being used. Caries risk forms can be scanned into electronic charting systems or be included in the treatment notes section of the chart. Depending on the dental software used, electronic systems may have the ability to provide pop-up alerts to notify the clinician of the patient's caries risk status. There are also a number of tools and applications to assist with patient compliance to CAMBRA recommendations. Consenting patients may be sent customized electronic reminders or voice mail messages with specific instructions based on their CAMBRA treatment recommendations.

Conclusion

CAMBRA is a philosophy of care that plays a key role in the transition of oral health care models from a surgical repair process to one that is based in health and wellness. The CAMBRA guidelines have been designed to assist oral health care providers better manage the caries disease process that is prevalent in every level of our society. Comprehensive risk assessment, as detailed in the CAMBRA protocols, plays a vital role in the development of effective, targeted disease prevention tools for providing excellent patient care. Because every dental practice is unique, interpreting and implementing CAMBRA will vary according to the unique needs of the individual practice population. There are many ways to create a CAMBRA program and the protocols are evolving continuously based on innovative scientific research and new preventive therapies. The authors hope that by providing information about

CAMBRA and the underlying science, that they are able to initiate the conversations that will support the adoption of CAMBRA and lay the foundation for the dental practice of the future.

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About the Authors

Karan Bershaw has been a practicing dental hygienist since her graduation from Oregon Health Sciences University in 1998. She has worked in a variety of private practices, participated in a practice-based research network and continues to be involved in many CAMBRA associated endeavors. She received her Master of Science Degree in Dental Hygiene from the University of California, San Francisco. Karan currently works in a private practice in Berkeley, CA.



Cheryl Ann Davis is an assistant clinical professor in the Master of Science Program, Department of Preventive and Restorative Dental Sciences, University of California, San Francisco. She received a juris doctorate degree from University of Tennessee School of Law, Knoxville, and worked for three years as a judicial clerk for a judge sitting for the Tennessee Court of Criminal Appeals and is a licensed attorney in the state of California. She received a baccalaureate degree in environmental science from East Tennessee State University and has worked for fifteen years as a clinical dental hygienist in northern California. Her passions also include education, research, and her work as a volunteer in various local programs assisting underserved communities.



Home Study Correspondence Course

“CAMBRA: From Research to Practice ”

2 CE Units – ADHA/CDHA Member \$25, Non-member \$35

Circle the correct answer for questions 1-10

1. CAMBRA is an acronym for _____.
 - a. Caries and microbial risk assessment.
 - b. Caries assessment and management prevention.
 - c. Caries management by risk assessment.
 - d. None of the above.
2. Which of the following is true about the white spot lesion?
 - a. The surface enamel is intact
 - b. It is a clinical sign of early caries
 - c. It can be reversible
 - d. all of the above
3. Which of the following are the primary causative agents necessary to initiate the caries process?
 - a. Lactic and proprionic organic acids
 - b. Mutans streptococci and lactobacillus
 - c. The red complex bacteria
 - d. Lack of salivary flow and frequency of carbohydrates
4. The CAMBRA disease indicators include: white spot lesions, approximal radiographic enamel caries, frank caries, and restorations placed within _____.
 - a. the previous three years.
 - b. the previous five years.
 - c. the previous seven years.
 - d. the previous ten years.
5. Remineralized enamel crystals are _____.
 - a. more susceptible to acid attack and stronger.
 - b. less susceptible to acid attack and weaker.
 - c. more susceptible to acid attack and weaker.
 - d. less susceptible to acid attack and stronger.
6. Use of fluoride in caries prevention strategies includes which of the following benefits?
 - a. Inhibits demineralization
 - b. Promotes remineralization
 - c. Inhibits bacterial growth
 - d. All of the above
7. CAMBRA caries risk factors include which of the following?
 - a. Exposed root surfaces
 - b. Recreational drug use
 - c. Inadequate salivary flow
 - d. Frequent carbohydrate snacks
 - e. All of the above
8. CAMBRA caries protective factors include all of the following EXCEPT one?
 - a. Use of fluoride toothpaste at least twice daily
 - b. Daily use of dental floss
 - c. Live, work or go to school in a fluoridated community
 - d. Use of calcium and phosphate supplemental paste during the past 6 months
9. Saliva plays a vital role in remineralization by:
 - a. Neutralizing the acids and raising the pH
 - b. Neutralizing the acids and lowering the pH
 - c. Providing a saturation of calcium and phosphate ions
 - d. Both a and c
10. Evidence based studies research indicate that the use of CAMBRA protocols result in:
 - a. A 10% reduction in new caries over time
 - b. A 20% reduction in new caries over time
 - c. A 30% reduction in new caries over time
 - d. A 50% reduction in new caries over time

The following information is needed to process your CE certificate. Please allow 4 - 6 weeks to receive your certificate.

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