Over the years, there has been a remarkable reduction of dental caries in the United States. Fluoridation of water, fluoridated toothpastes, professional dental products, improved oral hygiene, sealants and better access to care have contributed to this improvement. Unfortunately, despite the advancements, dental caries remains a significant problem, particularly in large segments of the population with the lowest access to care.

Early research models involving caries were simplistic and limited to investigating the interactions of plaque, diet and tooth structure. Interventions to arrest the caries process were surgical and only occurred after tooth cavitation. Today, the caries process is viewed as a disease entity that can be prevented or treated before the need for surgical intervention. Because of this, early detection, prevention, behavior modification and remineralization have become a major part of modern management of dental caries.

Early detection

To properly treat a patient, prevent decay and make product recommendations, an assessment process is essential. Previously, in order to assess tooth structure, a traditional method of exploring, radiographs and clinical exam took place. Today, this method is still used but with modifications. These traditional steps are combined with a newer approach of “caries management by risk assessment” (CAMBRA), an evidence-based approach to preventing or treating dental caries at the earliest stages. This new approach also includes additional options for testing and adjunctive detection devices. The change in approach requires clinicians to redirect assessment and treatment from being only a surgical or restorative approach to being a medical-model approach. This strategy is risk-based and implements appropriate therapeutic intervention (Featherstone, 2000).

Modifications in the traditional method of exploring are necessary to prevent cavitation of demineralized areas. The idea is to implement a soft, mapping approach with a blunt tip explorer rather than using a sharp explorer with a firm and pressing method. Changes in assessment and evaluations for radiographs include using the parallel technique with aiming devices versus use of the bisecting angle with no aiming devices. The parallel system is more consistent and reliable for a diagnostic or ideal radiograph that depicts accurate size and shape — with good detail, density and contrast (JADA, 2006).

Because dental caries is a chronic, transmissible and bacterial infection, it is regarded as a silent epidemic. A large portion of the population is affected early in life, and the disease continues throughout a lifetime (Bagramian, 2009). Because people are living longer and retaining their teeth longer, the implementation of the medical-model approach enables clinicians to be proactive instead of reactive, preventative instead of surgical.

Augmentation of the traditional method includes but is not limited to a risk-based approach of assessment: identifying risk factors and then manipulating...
contributing behaviors and habits to prevent carious lesions. In 1999, Dr. John Featherstone developed the “caries balance” (Fig. 1), a multifactorial process that balances protective factors and pathological factors (Featherstone, 2000).

Any imbalance of either side increases the risk for the development of dental caries. A CAMBRA clinical study is used to confirm the caries balance. The idea behind the CAMBRA is to prevent or treat the cause of dental caries at the earliest stage rather than waiting for irreversible damage to the teeth.

An assessment is done and the patient’s medical, dental and social histories are considered. The results are placed into a low-, moderate- or high-risk category. The CAMBRA clinical study confirms that fluoride alone cannot overcome a high bacterial challenge and that restorative treatment does not reduce bacterial count in the rest of the oral cavity. Moreover, one or more frank lesions indicate high bacterial challenge and high risk for future decay. And the use of chemical therapies can significantly reduce the level of new caries.

Research shows that 20 to 46 percent of the total population is affected by dry mouth, also known as xerostomia (Kutsch & Bowers, 2012). The natural protective function of saliva is to balance the ecological environment in the oral cavity. It helps maintain the pH, bathes and maintains the teeth for mechanical cleansing and clears ingested carbohydrates. There are many reasons a person can experience xerostomia; however, medications and systemic diseases seem to be at the top of the list.

To assess the quantity and quality of saliva, it is important to establish a base line through testing. The saliva test should include the assessment of stimulated and unstimulated pH, consistency, the quantity of flow production and the buffering capacity. A person produces about 1 to 1.5 liters of saliva per day. Anything less than this is considered low salivary function, and such patients should be placed in a moderate- or high-risk category, depending on other factors.

Adjunctive technologies are available and are an additional assessment tool to clinical findings. These technologies do not take the place of clinical examination, lab findings or radiographs; they augment the assessment phase to discover incipient lesions. Adjunctive technology options include:

- Loupes — magnification to enhance detection of demineralized areas.
- Digital fiber optic transillumination — a high intensity light that distinguishes demineralization through transillumination. It detects occlusal, interproximal, smooth surface and recurrent decay.
- Quantitative light fluorescence (QLF) — detects and monitors the progression of a lesion on occlusal and smooth surfaces. Although it is a good research instrument, it does not detect interproximal lesions.
- Infrared fluorescence — measures the fluorescence of cariogenic microbial on the occlusal surface and is translated into a numerical value. Calibration is necessary for each tooth.
- Light fluorescence — is much like the infrared fluorescence; however, this is an imaging software that gives quantified results of the occlusal surface.
- Red-infrared reflectance — one of the few interproximal devices on the market, it detects occlusal and interproximal lesions, emitting sound and light to signify when further investigation of demineralized areas is necessary.
- AC Impedance spectroscopy — a low voltage current evaluates the mineral density and rates it on a 0.0 to 100 scale with color to reflect the demineralized area. No calibration is necessary; however, software is needed to display and tabulate.

Behavior modifications

Once the assessment stage is complete, what is done with the information is an important piece of the puzzle. Modifications, corrective actions, therapies and product recommendations should include extensive home care instructions, pH neutralization, fluoride treatments, diet modifications, xylitol, chemical therapies and sealants. Education is a vital part of behavior modification, thus educational home-care instructions are necessary to communicate why it is critical to disrupt the biofilm with brushing, flossing and supplemental aids. These instructions, along with demonstration and interaction, will help educate the patient and reduce the amount of deposits and carious lesions.

Diet affects the pH through fermentable carbohydrates, which begin to break down in the oral cavity.
It is important to realize that the frequency of food consumption, time of consumption and types of foods consumed contribute to the demineralization process. Consumption of certain foods and drinks can alter the normal 6.7 – 7.0 pH level. Challenges associated with one of the most common dietary contributors to altered pH are confirmed by an example given in 2011 by Bill Marsh of The New York Times; he reported that the average American consumed 44.7 gallons of sodas per year (Marsh).

Unfortunately, sodas are not the only contributing factor: Fruit juices, energy drinks, coffees and alcoholic beverages are also on “The List” of acid challenges. There are many solid foods, too, that contribute to a lowered pH, such as certain cheeses, pickles, yogurts and fruits. These are only a small example of the many challenges.

Remineralization and therapies

Demineralizing and remineralization occur as a natural cycle of the oral cavity; however, if the pH level stays in a lower acidic zone, potentially more demineralizing could occur (Marsh). Balancing the pH can be done through xylitol products and a short-term therapy of 0.2 percent sodium hypochlorite rinse.

With xylitol products, cariogenic bacteria cannot be metabolized into acid, thus resulting in growth reduction and bacterial starvation. The sweet taste promotes salivary flow to aid in repair (Spolsky, 2003). The sodium hypochlorite rinse is bactericidal on contact to all bacteria. It has the capability to eliminate and reduce cariogenic microbes, while replacing them with healthy organisms. The disadvantage is that the rinse alters taste and it is recommended for only patients who are age 6 and older (Kutsch & Bowers, 2012).

Fluoride research started in the early 1900s by Dr. Frederick McKay, and today we still recognize the advantages of caries reduction through fluoride use. It strengthens teeth, inhibits bacterial metabolism, inhibits the production of acids or demineralization, and enhances remineralization. An average of 35 percent reduction in carious lesions can be demonstrated with fluoride therapy (Spolsky, 2003; Featherstone, 2000). Fluorides formulations are available as gels, foams or rinses, and it is found in toothpaste and water. As reported in the August 2006 Journal of the American Dentistry Association, gels and foams should be administered as a four-minute application in a tray, and all fluorides are recommended based on the patient’s age and level of risk.

Fluoride varnish is FDA-approved for sensitivity relief. Varnish acts by slowly releasing fluoride ions at the surface of the tooth. The high concentration of fluoride in varnish (22,600 ppm) produces sheet-like deposits of calcium fluoride that act as a reservoir, releasing fluoride over time. Wear time for release can be a little as two hours, while other varnish wear time is as long as four hours — and some recommend longer. A position paper published by the ADA Council of Scientific Affairs (JADA, 2006), recommends fluoride varnish for children under the age of 6 and for patients at high risk for dental caries.

Chlorhexidine rinse has been characteristically used in the past for dental caries therapy; however, recent studies have revealed that caries preventive therapy with chlorhexidine resulted in population increases of highly acidogenic or acid-tolerant Mutans streptococcus (Kutsch & Bowers, 2012).

An April 2011 JADA article states that except for CHX-thymol varnish every three months for root surface lesions, all other CHX products in any form, for any lesion site, for any age, are not recommended. Another chemotherapeutic rinse is 10 percent Povidone-Iodine, which reduces mutans streptococcus and lactobacillus in young children. It is administered only in the office — via swab or rinse (Featherstone, 2006). There is little evidence that PI is effective in adults, and until those studies are done, use of iodine in adults cannot be recommended as beneficial. (Featherstone, 2006; Kutsch & Bowers, 2012).

Sealants have been clinically proven to prevent dental caries in occlusal pits and fissures in many clinical trials. Placing sealants soon after eruption to prevent decay and deter the need for future restorative treatment is a part of preventative therapy. About 90 percent of carious lesions are found in...
the pits and fissures of permanent posterior teeth; therefore, this validates the need to seal the occlusal surfaces. According to Adair, sealants remain the most effective means for arresting or reversing these lesions. Additionally, earlier detection actually maximizes sealant effectiveness (Adair, 2003).

Remineralization with products such as nanohydroxyapatite and calcium phosphate technologies are a supersaturation of hydroxyapatite and fluorapatite. Although nanoparticles of hydroxyapatite are only 20 nm in size (1/850th the width of human hair), it is the most stable form of calcium phosphate. Studies demonstrate that nanoparticles mimic building blocks of natural enamel and are effective as an enamel repair material and anticaries agent (Kutsch & Bowers, 2012).

Other available technologies are amorphous calcium phosphate (ACP), casein phosphopeptide with ACP (CCP-ACP, Recaldent) and calcium sodium phosphosilicate (NovaMin). The two sources of calcium and phosphorous are salts: calcium sulfate and dipotassium phosphate. When the two salts are mixed, they rapidly form ACP that can precipitate onto the tooth surface. Once the ACP dissolves in enamel fluids, the calcium and phosphate ion precipitates and recrystallizes as apatite. The challenges of low substantivity and high solubility of ACP have resulted in the development of carriers that maintain and stabilize the calcium and phosphate ions in an amorphous form.

NovaMin reacts with saliva, enabling sodium ions to exchange with hydrogen ions, thus amplifying the natural protective mechanisms of saliva by raising the pH of the mouth. Calcium phosphate crystallizes to build a new hydroxyapatite-like layer over exposed dentin and within the dentinal tubules. Tricalcium phosphate (TCP) combines beta tricalcium phosphate and sodium lauryl sulfate to form a more functionalized calcium phosphate. TCP provides a slow release of calcium onto the tooth surface as it contacts saliva (www.rdhmag.com).

Bleaching is effective because it removes plaque, reduces caries bacteria, removes plaque and elevates pH on elderly patients. A customized tray with 10 percent carbamide peroxide is worn to reduce or kill lactobacillus, which minimizes the chance of decay (Haywood, 2007).

Caries infiltration is a micro-invasive treatment for incipient lesions, which reduces the lesion progression. It works in interproximal areas and smooth surfaces that mask white-spot lesions in one appointment. It works through filling, reinforcing and stabilizing enamel without drilling or sacrificing healthy tooth structure. It is described as bridging the gap between prevention (fluoride) and caries restoration.

Because of the role that bacterial biofilms play in the dental caries process, interest and research in probiotics has accelerated. Probiotics contain specific bacterial species that are considered GRAS, (generally regarded as safe) for human consumption. However, no two probiotics are alike, which means that consistency and reproducible results are difficult to achieve. Until further research is performed regarding probiotics, clinicians and patients should focus on creating a healthy oral environment by neutralizing the pH and supporting the patient’s natural healthy oral microflora (Kutsch & Bowers, 2012; Minocha, 2009).

Atraumatic restorative treatment (ART) is a minimally invasive approach to prevent dental caries and arrest the progression of carious lesions. ART includes sealing teeth before decay sets in, and if decay is present, restoring those lesions using glass ionomer temporary restorations. Like caries infiltration, ART is considered a treatment plan option that can bridge the gap between a surgical model of dental care and other preventive interventions (Gould, 2013).

Establishing a risk management plan for caries management should be no mystery. Implementation of the CAMBRA and ART approach will minimize the decay process and maximize prevention through products and protocol for caries reduction. Many people have seen benefits of the various methodologies of caries reduction, and usually it is the combination of any of the previously mentioned practices. Dental caries is still an epidemic, but with the goal of educating the patients, matching the treatment and product to the problem, oral health can improve._

Editorial note: A complete list of references is available from the publisher.