Air polishing

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Celebrating 100 years of dental hygiene

_How often do we get to celebrate a historical moment such as the 100th anniversary of dental hygiene? 2013 is truly a special year for those individuals who are dedicated to the prevention of oral disease. While gains have been made in some areas, there is still room for improving the oral and general health of the public.

What might the next 100 years hold for this profession? Just as there are new technologies to be heralded as presented in this publication, dental hygiene needs to continue to develop new ways of meeting the health needs of the public. Looking back, Alfred C. Fones conceptualized a hygienist as someone who would work in school systems to help children learn how to brush their teeth, reduce plaque and minimize oral disease. Looking ahead, we find ourselves wanting to reach beyond the classroom and the clinical operatory to an arena of settings that expand the concept of health homes.

Inter-professional or collaborative models of care may be the closest we can come to creating health homes for those in need. Being inclusive and capitalizing on the expertise of a group of health care professionals may help all providers bring the best to patient/client care. Working toward achieving health for individuals, families and communities can change the narrative about the health of America from one that’s defined by worries about how to obtain health resources to one that reflects a commitment to improved health for all.

Remarkable as it may seem, the time arrived long ago when oral health professionals had to become advocates for health care by first capturing the interest of policymakers who neither fully understand nor feel the need to change the health care system. Despite the many reports that reflect the less than terrific health of the nation, if oral health care providers do not advocate for change, policymakers will not either.

To improve the oral health of the country, we need to look beyond today — far into the future. We must create an educational experience that changes the culture of dental hygiene science and practice. We must strive for creating and testing new models of health care, looking at outcomes as a means to an end. We must teach the dental hygienists of the future to be accountable for achieving prevention. To do that, hygienists will need to be flexible, alert for opportunities and willing to chart new territory.

When we get to 2113, let’s hope those looking back at us see us as the pioneers who were able to eradicate oral diseases — and enable the public to enjoy a lifetime of health.

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The pH scale

- Battery acid
- Stomach lining acid
- Vinegar, lemon juice
- Soda, mango juice
- Tomato juice, acid rain

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The concept of air polishing is based on a technology developed by Dr. Robert Black in 1945. Black invented a device called the Air Dent, which used compressed air, water, and a highly abrasive powder to eliminate pain from cavity preparation, making anesthesia unnecessary.

While the Air Dent presented many problems, the technology represented the first step in air-polishing devices. Air polishing was first marketed in 1976, and from that time forward it became widely available.

Air-powder polishing is accomplished by the propulsion of abrasive particles through a mixture of compressed air and water through a handpiece nozzle. The handpiece nozzle through which the slurry is propelled is activated with a foot control. The air pressure produced, measured in pounds per square inch (psi), depends on the type of air-powder polisher being used.

Air-powder polishers are manufactured as separate handpiece units that attach directly to the air/water connector on the dental unit as a separate device or in combination with an ultrasonic scaler.

Indications for use

Coronal polishing is a cosmetic procedure designed to remove extrinsic stains from the enamel surfaces of the teeth. This can be accomplished by abrasion and erosion of the extrinsic stain. The most common technique for stain removal is rubber cup polishing. This technique uses an abrasive polishing agent and a slowly revolving polishing cup to abrade stain from the tooth surface. Air-powder polishing is accomplished by erosion of extrinsic stains by suspended abrasive particles within a moving fluid. Kinetic energy propels the air-powder polishing slurry particles against the tooth surface, thus removing stain (Figs. 1a, b).

The air-powder polisher is shown to be efficient, safe and effective in removing extrinsic stain and plaque biofilm from tooth surfaces. It is equally effective in decreasing root surface roughness after instrumentation. It is also reported to remove plaque biofilm and staining as effectively as a rubber cup and does so in less time. Patients often exhibit extensive...
staining on root surfaces, specifically on areas of recession and at the cementoenamel junction. Removing these stains with a curet has been shown to reduce root structure. However, when stain removal is for esthetic reasons, the air-powder polisher is preferable to the curet. The air-powder polisher removes less root structure than the curet in simulated three-month recalls for three years. The stain was also removed more than three times faster with the air-powder polisher.5

Using the air-powder polisher also creates less discomfort for patients who have dentinal hypersensitivity because the sodium bicarbonate particles embed in the dentinal tubules, lessening dentinal hypersensitivity discomfort almost immediately. In vitro, research has shown that there is little or no disruption of enamel, cementum and dentin surfaces with air-powder polishing.

Other research has shown that air-powder polishing can render cementum surfaces more uniformly smooth, compared with traditional polishing or the use of curets.5

The air-powder polisher can remove subgingival bacteria through the Venturi effect. This occurs when the air/water/powder spray is directed at a 90-degree angle to the interproximal spaces so that a vacuum is created that extracts tissue fluids, including subgingival bacteria from the subgingival space. The air-powder polisher has been used for debridement of Class V abraded areas before placement of glass ionomer cements.

When compared with cleaning the area with a rubber-cup polisher, the air-powder polished tooth had less microleakage around the enamel-cement interface. Similar results were noted when using the air-powder polisher before sealant application. It was reported to be superior to rubber-cup polishing in preparing enamel for etching and sealants.

Deeper resin penetration into enamel and increased sealant bond strength was also reported in comparison with traditional polishing with pumice and water. In addition, clinicians prefer using the air-powder polisher on orthodontic patients, and research has shown that it does not affect the bracket adhesive system.

_Types of powder

The most common type of abrasive particle used with the air-powder polisher is sodium bicarbonate, which is treated to be free-flowing with calcium phosphate and silica. Sodium bicarbonate is a food grade material, and each particle is approximately 74 mcm in size. The Mohs’ scale hardness number for sodium bicarbonate is 2.5. In comparison, Pumice has a Mohs’ hardness number of 6.

Sodium bicarbonate is safe for use on enamel, amalgam, gold, porcelain, implants (titanium) and orthodontic materials. However, its use should be avoided on all types of composites, glass ionomers and luting agents (cements).13 When used on implants, air polishing with sodium bicarbonate, should not be directed subgingivally, thus it is the method of choice for decontamination of implants.

A sodium-free powder for air-powder polishing is available (Fig. 2) (Jet Fresh from DENTSPLY Professional, York, Pa.). Developed for patients who are sodium intolerant, this powder is made of aluminum trihydroxide, which has a Mohs’ hardness number of 2.5 to 3.5 and a particle range in mesh size from 80 mcm to 325 mcm.

Aluminum trihydroxide powder is safe for enamel; however, it is too abrasive for use on other tooth structures, and its use should be avoided on all dental materials. While using aluminum trihydroxide does not cause surface disruption to porcelain, its use can remove the luting agent, causing a compromise in the margin integrity that can quickly lead to decay.5
Patient assessment

Because of the various indications and contraindications associated with use of the air-powder polisher, patient assessment and treatment planning are critical prior to use. The patient assessment process should include a thorough health history evaluation to identify and possibly rule out patients who have hypertension and/or are on a physician-directed, sodium-restricted diet. However, the amount of sodium bicarbonate ingested during air polishing is not sufficient to cause alkalosis or an increase in blood pressure or sodium levels in the blood.

Other patients who are contraindicated include those who have end-stage renal disease, are immunocompromised, have a communicable infection or have Addison’s or Cushing’s disease. In addition, patients with respiratory problems, such as chronic obstructive pulmonary disease or any condition that interferes with breathing or swallowing, should be treated with an alternative approach. Such patients could be compromised by the aerosols created by air-powder polishing, and they are also vulnerable to the development of pneumonia. Contraindications for using the air-powder polisher also include patients taking potassium, anti-diuretics or steroid therapy—all of which can disrupt the acid/base balance.

Contraindications for use of the air-powder polisher also extend to the hard and soft tissues; therefore, the dental history assessment is paramount. Hard tissue that presents with any composite resins, sealants or glass ionomers should be avoided because of susceptibility of those materials to surface roughness or pitting.

Porcelain margins and margins of all restorations can be altered by extensive exposure of the air-powder polisher, and this can lead to loss of marginal integrity, surface roughness, staining and pitting. Exposed cementum or dentin, because they are not as mineralized as enamel, are more susceptible to abrasion. In addition, patients who present with active periodontal conditions with soft and spongy tissue are contraindicated because the air-powder polisher can cause air embolism or small blood clots. Lastly, pediatric patients with deciduous teeth or newly erupted permanent teeth are contraindicated.

Patient preparation

It is with utmost importance that before using the air-powder polisher, clinicians must prepare themselves and their patients. Patient preparation would include a thorough explanation of the procedure, review of medical history and taking of blood pressure. The clinician should place a disposable or plastic drape over the patient’s clothing, provide the patient with safety glasses and confirm removal of contact lenses. The clinician should make sure the patient is in a more upright position. A non-petroleum lubricant should be applied to the patient’s lips to protect them from the abrasive spray, which can dry the lips.

Research has confirmed that when the clinician performs air-powder polishing, aerosols of microorganisms can contaminate surfaces several feet from the operative site. Instructing the patient to use an antimicrobial preprocedural rinse, such as 0.12 percent chlorhexidine, can reduce risk of bacterial contamination from these aerosols.

Air-powder polishing unit and operator preparation

The clinician should be properly protected when performing air-powder polishing. Standard precautions include wearing fluid-resistant protective apparel, using a face shield or protective safety glasses with side shield and wearing gloves and a well-fitting mask with high filtration capabilities. In addition, because of the risk of contamination from the aerosols, the use of a high-speed evacuation system is recommended. Clinicians should always follow the manufacturer’s user directions that are specific to the air-polishing unit being used.

Unit preparation includes obtaining all necessary equipment, such as the air-powder polisher and abrasive powder, according to patient selection. The unit and handpiece nozzle is prepared according to manufacturer’s directions, and the powder compartment is filled with the appropriate abrasive recommended for the machine being used (Fig. 3).

The unit should be turned on for at least 15 seconds to eliminate residual powder or moisture in the lines. Also, water lines need to be flushed before use.
‘The patient assessment process should include a thorough health history evaluation to identify and possibly rule out patients who have hypertension and/or are on a physician-directed, sodium-restricted diet.’

according to the recommendations of the Centers for Disease Control and Prevention. When the unit’s chamber is being filled with abrasive powder, the unit must be turned off. It needs to be filled with powder to the top of the center tube. The clinician can place a finger over the tube in the middle of the chamber to prevent powder from blocking the air line. Next, the clinician needs to use the control on top of the powder chamber cap to adjust the powder flow according to the patient’s needs. For treating patients with heavy stains, it is recommended that the control knob should be turned to “H” for heavy powder flow, which is approximately the 12 o’clock position. For patients with light staining, the control knob will be set to “L” for reduced powder flow, which is approximately the 6 o’clock position (Fig. 4).

An aerosol-reduction device that connects to the saliva-ejector or high-speed-evacuation system used with the air-polisher handpiece has been shown to be effective in controlling and reducing air-powder aerosols, thus decreasing the potential for disease transmission. The aerosol-reduction device reduces or eliminates the visible aerosols normally produced during air-powder polishing. Additionally, the aerosol-reduction device (Fig. 5) eliminates the need for exact angulations with cup/nozzle, use of gauze, hand cupping and patient positioning.

Another advantage to the aerosol-reduction device is that it minimizes the possibility of tooth abrasion because the cup is placed on the tooth — as in traditional polishing techniques. When using the aerosol-reduction device, the clinician must follow the manufacturer’s instructions for assembling and disassembling. The aerosol-reduction device contains two parts, a disposable cup that attaches to the air-powder polisher nozzle and a clear tube extension that is attached to the saliva ejector or high volume evacuator (HVE).

Clinical technique

There is a universal air-powder polishing technique that can be used with all types of systems, however manufacturers may have different instructions for use of their equipment.4 The recommended technique prevents undue aerosols from deflecting back to the clinician or being directed into the patient soft tissues. The use of high-speed evacuation or the aerosol-reduction device is the most efficient way to control the aerosol spray. While positioning of the patient and operator are basically unchanged, direct vision and access become elementally important when the polisher is active.20

Positioning the patient slightly upright at 45 degrees with the patient’s head toward the operator to access areas — and reclining to treat maxillary lingual surfaces — provides a better field of vision and increase patient comfort. Placing moistened 2-by-2-inch gauze square over the tongue or on patient’s lip near the work area will help reduce burning and stinging experienced by some patients. The rheostat has two compressions levels: Full compression releases the aerosol powder-abrasive from the tip, and halfway compression produces a stream of water for rinsing and cleaning. Before the polisher is activated in the patient’s mouth, it is recommended that the clinician check the amount of water and powder coming from the unit, test the sensitivity of the alternating cycles and confirm the powder-to-water ratio.20

The clinician should establish and maintain a systemic pattern when using the air-powder polisher. The nozzle tip should maintain an appropriate distant from the tooth surface (approximately 3 to 4 mm). Holding the nozzle farther away from the tooth surface is not recommended because that reduces the abrasive action and increases aerosol production. Cupping the lip with the index finger and thumb to pool water in vestibule minimizes aerosol and eases evacuation. The nozzle tip also should be angled diagonally so that the spray is directed toward the middle third of the tooth.

The clinician should use a constant circular motion, sweeping or paintbrush motion from interproximal to interproximal. In addition, a systemic approach of polishing one or two teeth at a time will ensure that all tooth surfaces are adequately polished. And alternate cycles of full-compression powder-spray and half-compression rinse every two or three teeth will increase efficiency and patient comfort.20 The clinician must polish each tooth approximately one to two seconds; and to avoid loss of tooth structure, not subject any tooth to more than 10 seconds of air-polish slurry. Root surfaces should be exposed to slurry for even less time or entirely avoided because they abrade more rapidly than enamel.

The DENTSPLY Cavitron Jet Plus™ has Tap-On™ technology (Fig. 6) that automatically cycles between
rinse and polish, thus eliminating the need for the clinician to pump the pedal. Tapping the foot pedal once activates the Tap-On automatic air polishing/rinse cycle, which lasts for approximately one minute. Tapping the pedal a second time disables the automatic air polishing/rinse cycle.

The autocycles work in short, medium or long settings (Fig. 7) within timed cycles of one minute. Each cycle begins with a two- to three-second stream of water. The “short” autocycle is 0.75 seconds of air-powder polishing followed by a 1.25-second rinse; the “medium” autocycle is two seconds of air-powder polishing followed by a one-second rinse; and the “long” autocycle is three seconds of air-powder polishing followed by a two-second rinse.

The “manual” cycle setting enables the clinician to use the Tap On foot technology control to alternate manually between air-powder polishing and rinse.

When air-polishing the anterior teeth, the tip should be directed at a 60-degree angle to the tooth; for posterior teeth the angle should be 80 degrees; and for occlusal surfaces, a 90-degree angle is recommended. Using the aerosol-reduction device, the clinician will apply the disposable cup (attached to the nozzle) to the middle third of the tooth with light pressure to flare the cup. The clinician will then pivot the nozzle inside the cup to adapt to all areas of the tooth surface and polish for two seconds of spray for each segment of tooth.

Completion of air-polishing procedure

At completion of the air-polishing procedure, the clinician should rinse the teeth thoroughly, floss all interproximal surfaces and inspect the teeth for any remaining stain. Thorough rinsing is essential after air-powder polishing because of the basic nature of the sodium bicarbonate.

If stain is still present, reinstrumentation and/or use of the air-powder polisher may be indicated. Any debris should be wiped off the patient’s face with a moist towel. A re-application of lip balm should be offered.

The aerosol-reduction device should be disposed of and the nozzle should be cleaned with a wire-cleaning tool to prevent clogging. Nozzle tips must be autoclaved after each use, and the entire unit should be disinfected with an EPA-approved disinfectant. Using a disposable barrier will help minimize disinfecting time.

At the end of the workday, the unit should be turned off, powder removed from chamber and unused powder discarded to prevent clogging of lines. Also, keep the powder chamber and air lines free of moisture, which can cause the system to fail. The clinician then needs to remove any residual powder from the chamber with an HVÉ and activate the unit for approximately 15 seconds to clear any powder remaining in the chamber.
_Conclusion_

Therapeutic polishing is the removal of toxins from the unexposed root surfaces, which results in a decrease in disease parameters. Polishing root surfaces is possible with both the rubber-cup or air-powder polisher; however, the rationale for selecting the air-powder polisher is for its effectiveness and efficacy.20

The clinician should follow the precautions and considerations presented when polishing for therapeutic benefits with the air-powder polisher. The clinician should be aware to direct the air-powder spray against the tooth surface, not the exposed soft tissues. Most importantly the clinician must consider all options — esthetic, therapeutic and patient goals — when designing a treatment plan that meets the individual patient’s specific needs._

_References_


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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 foods consumed contribute to the demineralization process.
In caries management, the sealants and other preventive procedures have been limited to 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 substantiality 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.
Tooth hypersensitivity caused by exposed dentinal tubules is prevalent in the adult population, affecting as many as one in three adults. Periodontal patients have historically demonstrated the highest prevalence, with 60–98 percent of patients reporting sensitivity. This higher prevalence in periodontal patients is expected, given the exposure of the root surface resulting from both the disease process and the treatment of the disease.

Most dental professionals perceive that the number of general-population patients experiencing sensitivity is growing. Such an increase in prevalence in the general population might also have been anticipated, particularly given the increasing usage of tooth-whitening products and the increasing consumption of acidic foods and beverages (e.g., fresh fruits, juices, carbonated beverages), which promotes acid erosion of the tooth structure, as each is recognized as a contributing or causative factor for dentin hypersensitivity.

Dentin hypersensitivity is characterized by short, sharp pain arising from exposed dentin in response to stimuli — typically thermal, evaporative (movement of air over the tooth), tactile, osmotic or chemical — which cannot be attributed to any other dental defect or disease. For hypersensitivity to be experienced, two processes must have occurred: 1) exposure of the dentin, typically resulting from gingival recession and 2) opening of the dentinal tubules, usually through loss of the smear layer, predominantly from acid challenges. Any tooth may be affected, but the most common sites for dentin hypersensitivity are the buccal cervical areas of the cuspids and premolars.

Surprisingly, a majority of patients do not seek treatment to relieve their dentin hypersensitivity pain. The subtle onset of the sensitivity allows for the unconscious development of coping strategies to minimize the discomfort, such as avoidance of ice, drinking through straws and brushing with warm water. Additionally, patients may not perceive the sensitivity to be a severe problem, or conversely, they may fear it is a sign of a more severe problem and choose to tolerate it rather than seek invasive treatment.

Given the increase in prevalence of dentin hy-
hypersensitivity and the reluctance of patients to seek treatment, it is increasingly important for the dental professional to screen for hypersensitivity as part of a routine dental assessment. The prophylaxis or perio maintenance appointment provides the dental hygienist an ideal opportunity to identify areas of gingival recession and then to evaluate those recessed areas for hypersensitivity during the course of the visit as various stimuli are experienced by the patient — instrumentation (tactile), air ( evaporative), and water (thermal).

Sites of sensitivity can be documented, including duration, onset and the nature of the stimuli initiating the hypersensitive reaction. All contributory and predisposing factors and conditions should be explored, such as gingival recession, tooth wear, oral hygiene and any harmful habits.7

Once sites of recession and hypersensitivity are noted, the dentist can make a differential diagnosis, ruling out other causative factors for the sensitivity (cracked tooth syndrome, caries, etc.) to confirm the diagnosis of dentin hypersensitivity.

With a confirmed diagnosis, whether generalized or localized, a treatment plan can be designed to manage the discomfort of hypersensitive dentin, as well as the contributing or causative factors identified for each individual patient.

Prevention of hypersensitivity is the most cost-effective treatment option for patients.7 By identifying the factors contributing to the hypersensitivity, patients can be educated to modify their behaviors to minimize or prevent the occurrence of pain. Behavioral modifications may include changing the technique used when brushing teeth and avoiding brushing immediately after ingesting acidic foods and drinks. Patients at risk of acid wear may be advised to modify dietary habits when consuming acidic foods and beverages that contribute to erosion and exposure of the tubules. Patients utilizing whitening products should be given instruction on how to modify the whitening process to avoid or manage the sensitivity associated with tooth whitening.

Treatments for hypersensitive dentin can be self-applied by the patient at home or be applied in-office by a dental professional, and work by either occluding the dentinal tubules or blocking nerve conduction by depolarizing the nerve. As patient-applied treatments tend to be simple and inexpensive and can treat generalized hypersensitivity affecting many teeth,4 they should be prescribed as the first line of treatment.

The effectiveness of over-the-counter desensitizing fluoride toothpastes that contain 5 percent potassium nitrate as the desensitizing agent is well established. The level of potassium at the dentin surface will increase following each use of potassium nitrate toothpaste. This localized increase in concentration is hypothesized to lead to a diffusion of potassium ions through the tubules, toward the pulp, where it could interrupt nerve conduction.

Twice-daily toothbrushing with a potassium nitrate toothpaste provides the regular doses of potassium to the dentin surface necessary to build up and then maintain the depolarizing activity of the potassium ions. A significant reduction in sensitivity can occur within as little as two weeks with twice-daily application.8,9

Continual use of the desensitizing dentifrice is effective for long-term relief.10,11

Surprisingly, a majority of patients do not seek treatment to relieve their dentin hypersensitivity pain. The subtle onset of the sensitivity allows for the unconscious development of coping strategies to minimize the discomfort.
necessary for ongoing protection, so to favor patient compliance, sensitivity dentifrices are available in a variety of formulations to meet the patients’ needs and desires, such as tartar control, whitening and sodium lauryl sulphate-free formulations.

If the patient’s dentin hypersensitivity persists after four weeks usage of the OTC desensitizing toothpaste, a further dental examination should be carried out, and a professional treatment should be considered as the second line of treatment.

Recently developed calcium phosphate technologies have also demonstrated effectiveness in tubule occlusion, including ACP, CPP-ACP, and NovaMin®, a calcium sodium phosphosilicate. The effectiveness of NovaMin in occluding dentinal tubules is attributed to its unique mechanisms of action. Not only do the NovaMin particles immediately bind to exposed dentin and fill open tubules, the subsequent release and surface reaction of calcium and phosphate ions forms a protective hydroxyl carbonate apatite-like layer that provides tubule occlusion, which is resistant to the challenges of acidic environments.10,11

Treatment for dentin hypersensitivity should also be included in routine preventive and periodontal therapies. The instrumentation used during adult prophylaxis, perio maintenance and periodontal debridement (SRP) procedures can cause pain at pre-existing hypersensitive sites and may result in new sites of transient hypersensitivity.

To manage hypersensitivity stimulated during and following periodontal instrumentation, the continuous care treatment strategy can include usage of NUPRO® Sensodyne® prophylaxis paste with NovaMin. As detailed previously, the incorporation of NovaMin particles into the prophyl paste provides immediate tubule occlusion and formation of an acid-resistant hydroxyl carbonate apatite-like layer.14

NUPRO Sensodyne prophyl paste with NovaMin, available in polishing and stain-removal grits, can be used for the immediate relief of tooth sensitivity and for lasting sensitivity relief for up to 28 days after just one application.12,13 A thin, white residue might remain visible after rinsing. This is inherent in the product formulation and is considered normal.

For localized hypersensitive sites that do not respond to the first or second lines of treatment, in-office treatments that are more complex and/or more potent may be indicated. Such treatments involve use of adhesives, including varnishes, bonding agents and restorative materials: iontophoresis, lasers or gingival grafting. One option, NUPRO White Varnish (Fig. 1), is a uniquely formulated varnish for hypersensitivity relief; another option is Seal & Protect™, a protective light-cured sealant indicated for use in the treatment of hypersensitive cervical areas.15

Effective prevention and management of dentin hypersensitivity requires a continuous care approach. The continuum of care starts with a screening assessment for hypersensitivity, followed by identification and modification of causative factors to help prevent hypersensitivity.

A combination of at-home and in-office therapies...
The continuum of care starts with a screening assessment for hypersensitivity, followed by identification and modification of causative factors to help prevent hypersensitivity.

Hypersensitivity Consensus Monograph 2008;4(9 Special Issue).


11. Data on file


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16. Data on file

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Gail Malone, RDH, BS, is a clinical educator for DENTSPLY Professional, serving the northeast region of the United States. She received her dental hygiene degree from Montgomery County Community College in Blue Bell, Pa., and received a bachelor’s degree in dental hygiene from Thomas Jefferson University in Philadelphia, where she also served as adjunct faculty. Malone’s more than 20 years of experience in the field of dentistry includes experience in clinical practice, dental hygiene education, dental practice management and dental distribution. She has lectured internationally, nationally and at the state and local level on ultrasonics, local anesthesia and a variety of other topics. Her aim is to provide dental professionals with current scientific research and information to assist them in implementing effective and efficient evidence-based treatment protocols in their clinical practices. You may contact her at gail.malone@dentsply.com.
Achieving a balance between implant-supported restoration esthetics and maintaining periodontal health is important in an overall successful outcome of the prosthesis. The goal is to create an emergence profile design that allows for minimal tissue displacement while achieving optimal cervical contours for esthetics. It is important in the design to allow access for proper cleaning by the patient and clinician (Fig. 1).

There are two types of implant restoration designs commonly used in single-tooth replacement prosthetics. They are a screw-retained crown or a two-piece abutment and cement-retained crown. The screw-retained crown design is the technique more commonly used in Europe. Whereas, the cement retained crown prosthesis is more frequently used in the United States.

The screw-retained restorations contain a small chimney access hole where the screw retaining the restoration is inserted. The crown is screwed directly into the implant and the access chimney is typically closed with a tooth-colored resin (Sarmont, 2009). There are two main advantages of this restoration design. First, since cement is not used in this method, the opportunity for subgingival residual excess cement to remain on the prosthesis cannot occur. When excess cement is left, it can create the opportunity for inflammation and peri-implantitis to develop in the implant sulcus site. Second, the screw can be easily removed from the restoration, allowing for crown removal if necessary during any maintenance procedures.

The two-piece abutment and cement-retained crown restoration has an abutment that is designed to provide the subgingival emergence profile and allows the crown to be cemented onto the abutment (Fig. 2). The emergence profile refers to the subgingival contours that lie between the implant platform and the emerging abutment and crown (Sarmont, 2009). Using a custom designed abutment provides greater flexibility in determining the proper shape of the emergence profile compared with pre-fabricated standard abutment design.

To obtain a pleasing restoration, the subgingival contours must start at the small circle of the implant head and emerge from the tissue with an anatomical profile (Sarmont, 2009). The result should be an emergence profile that allows for minimal displacement of the surrounding tissue while creating an esthetically pleasing appearance (Fig. 3). This design allows for easy access into the implant sulcus area so cleaning and maintaining can be easily achieved by both the patient and the clinician. Over or under contouring of the abutment and/or restoration can result in biofilm retention and peri-implantitis. It is important for the emergence profile to resemble that of a natural tooth so the patient and the clinician can easily maintain the implant prosthesis. (Photos/Provided by G P Mora, CDT)
Fig. 3. Ideal sulcus formation created by proper emergence profile of the implant abutment.

Fig. 4. Cavitron® SofTip™ Ultrasonic Implant Insert (Photo/Provided by DENTSPLY Professional.)

of a natural tooth. Often the adjacent teeth can be used as a guide to determine the proper contours.

The protocol for margin location of a standard implant restoration is still under debate. As the location of the crown abutment margin is placed deeper subgingival, the ability to access and maintain the site become more difficult (Linkevicius, 2012). What does this all mean for the clinician and patient in the maintenance of the implant prosthesis?

Access to the subgingival area of the implant prosthesis for proper maintenance is vital to the health and success rate of the prosthetic teeth. As margin location and emergence profiles extend farther subgingival, the ability to maintain these sites becomes more challenging.

Evidence has shown that power scalers with non-metallic tips can be beneficial in maintaining the implant prosthesis (Sato, 2004). Several manufacturers offer tip designs that will accommodate the different types of power scalers. DENTSPLY Professional has an insert whose unique design allows a polymer sleeve to be assembled to the active tip area of this ultrasonic implant insert (Fig. 4). When fully assembled, the Cavitron® SofTip™ Ultrasonic Implant Insert can easily be incorporated into a clinicians’ implant maintenance procedure.

Incorporating ultrasonics scaling into the implant maintenance protocol may have several benefits. Combining mechanical movement and lavage can aid in the removal of biofilm and other debris in the implant prosthesis sulcus. Wilkins wrote in 2012: “Studies indicate cavitation is capable of destroying subgingival bacteria and can remove endotoxin from the root surface.” And: “Oscillation of the ultrasonic tip causes hydrodynamic waves to surround the tip. This acoustic turbulence is believed to have a disruptive effect on surface bacteria” (Wilkins, 2012). Multiple in vitro studies have discussed that cavitation may have the potential to disrupt the cell wall of the bacteria, and acoustic turbulence is believed to have disruptive effect on the surface bacteria (Baehni, 1992; McInnes, 1993; Walmsley, 1990). However, further in vivo studies need to be conducted to determine if the same outcomes are achieved in the sulcus.

Another benefit to incorporating power scaling into the maintenance procedure is the ability to adapt the active tip area into the implant sulcus. Incorporating vertical adaptation of the active tip, at a zero- to 15-degree angle, to the implant restoration can allow for significant subgingival surface contact for efficient deposit removal. When the emergence profile follows the anatomical shape of a natural tooth, this instrumentation technique can be an effective method of maintaining the site.

Finally, easy access for the patient is extremely important in the success of the implant prosthesis. There are a variety of interdental brushes, cleaners, and floss options available to the patient. It is important that the cleaners be easy to use, not cause tissue trauma in the implant sulcus, or surface damage to the esthetic materials in the restoration.

Dental implants are increasing in demand in part by their high success rates and the improved esthetics they provide the patient. A key to this success is having the proper design incorporated into the restoration. When designed properly, the implant restoration can be easily maintained by both the patient and clinician.

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