



Are You Worried About Radiation?

Gordon's Clinical Bottom Line: It is well known that digital radiography requires far less radiation than analog. This knowledge has inadvertently influenced some dentists and staff to be less concerned about exposure to themselves. It is our observation that many offices are not using the same precautions that were once strictly followed. Most dentists and staff admit to occasionally holding sensors during exposure, standing close to patients, decreasing use of lead aprons, and doing several re-takes because it is so easy. *Are these practices dangerous or not? This CR study seeks to answer this all too important question.*

Dental radiographs provide proven benefits for the diagnosis and treatment of oral conditions with only minimal risk compared to other sources of radiation and other life activities in general. Dental x-rays occasionally receive negative publicity because radiation, and its interaction with human tissues, is often poorly understood. Current radiography equipment and techniques can reduce exposure to near negligible levels for patients, public, and office staff. Proper safeguards and techniques should be used when working with x-rays to ensure that the benefits are always greater than the risks for everyone involved.

The following report compares common radiation sources, states current exposure standards, discusses safe practices, and provides CR conclusions.

Continued on page 2

Endo Access through Ceramics: Are Cracks a Problem?

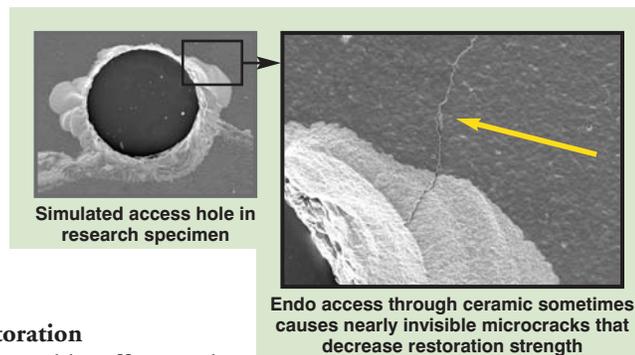
Gordon's Clinical Bottom Line: What happens to a zirconia (such as BruxZir) or lithium disilicate (IPS e.max) restoration when you must make an endodontic access opening through the materials? We know that some PFM restorations are short lived after this procedure. It is well known that many of the newer ceramic restorations require endodontic therapy on the tooth subsequent to placing the restorations. Will these materials be threatened by making an endodontic access opening? *This CR scientific study answers your questions about endodontic access through the newer ceramic restorations, and it may encourage you to accomplish endodontic treatment before seating restorations on suspect teeth.*

When a tooth with an indirect restoration (usually a crown) requires endodontic treatment, the clinician has two options:

1. Remove the restoration and fabricate a replacement
 - Less common, due to increased cost to patient
 - Increasing in prevalence for dentists using in-office CAD/CAM milling
2. Leave the original restoration in place and restore through the opening
 - Sometimes cracks (from large to micro-sized) are induced by cutting an access opening and may propagate over time to cause restoration failure
 - Certain precautions can be taken to minimize cracking

This report presents useful information on how ceramic restoration material, restoration occlusal/incisal thickness, cutting instrumentation, handpiece, and other clinical variables affect crack formation during endodontic access through several types of ceramics. A performance comparison of diamond burs recommended by multiple manufacturers for this procedure is also provided.

Continued on page 3



Xerostomia: The No Spit Zone—Causes and Potential Solutions

Gordon's Clinical Bottom Line: What dentist has not had difficulty successfully treating and maintaining the many patients who suffer from xerostomia? What are the major causes of this problem? Are there methods to reduce xerostomia? Should we use medications to reduce it? What is the effect of xerostomia on successful placement and longevity of restorations, new carious lesions, dentures, periodontal disease, soft tissue pathologic conditions, and overall oral health? *This CR article will help you to answer these questions.*

40% of individuals younger than 55 years of age have some degree of xerostomia. 40,000 head and neck cancer irradiated patients have xerostomia; 4 million Sjögren's patients suffer with xerostomia. By 2050, the number of people living to 75 years of age or older will double, potentially doubling those affected with the dental and other deleterious effects of dry mouth. **More than 400 drugs and 42 drug classifications adversely affect the production of saliva.** Read on to learn the symptoms of xerostomia, some of the causes, and potential treatments.

Continued on page 6

Noteworthy Products

BLOXR Thyroid Collar:

Lead-free, lightweight, thyroid collar is as effective as 0.5 mm lead collars. (Page 4)

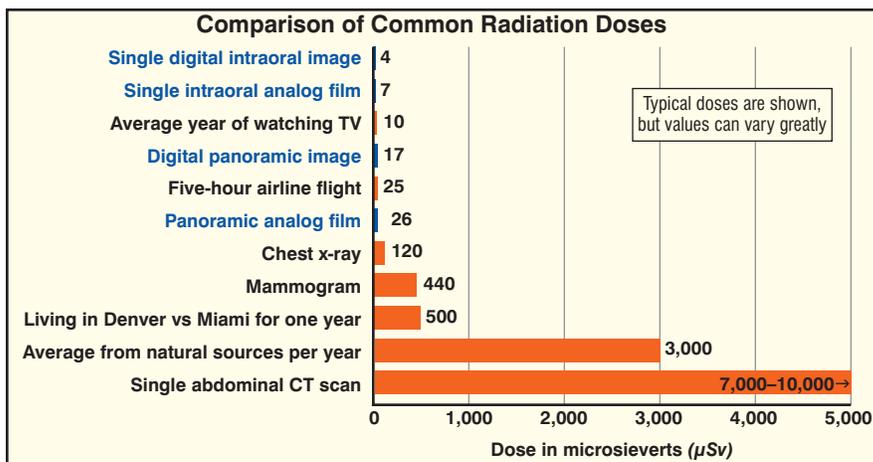
Retraction Capsule:

Easy gingival retraction with an astringent paste syringed through very fine tip. (Page 4)

Are You Worried About Radiation? (Continued from page 1)

What is an appropriate radiation dose?

The dose should be just sufficient to achieve the medically necessary image. Exposure limits are established for those working with radiation, not for patients. The graph shows typical doses from various sources and activities and illustrates the small risk posed by dental radiography. Dose is expressed in microsieverts (μSv), a unit which expresses the effect of radiation on body tissues.



- Dental exposure is only a small part (<0.3%) of a person's annual exposure from all sources.
- Risk from dental exposure cannot be reliably distinguished from other sources.
- Clinicians should minimize exposure according to the ALARA principle (*As Low As Reasonably Achievable*) to minimize risk of stochastic effects (*effects determined by probability*), such as cancers.

Recommended dose limits of the NCRP (*National Council on Radiation Protection and Measurements*)

- 50,000 μSv /year for clinical staff working with radiation
- 1,000 μSv /year for general public (*e.g., family member in waiting area or accompanying the patient in operatory*)

How much radiation do staff members receive?

Most of the x-ray beam is absorbed by the target tissues of the patient. The remaining beam and scattered x-rays diminish rapidly with distance (*inverse square law*). Consequently, the radiation drops to a negligible level within a few meters.

- **If assistant holds the x-ray head** to stabilize it against the patient, the dose would be approximately 0.3 to 2.0 μSv , depending on equipment, settings, and assistant's position relative to x-ray head. If all radiographs were made this way, a single dental assistant could receive **1,400–30,000 μSv per year**, which is still below the occupational limit.
- **If assistant remains in the operatory** during x-ray, the dose would be approximately 0.1 to 0.2 μSv . If all radiographs were made this way, a single dental assistant could receive **450–3,300 μSv per year**.
- **If assistant steps out of the operatory** during x-ray, the dose would be undetectable to approximately 0.1 μSv , or **0–1,500 μSv per year**.
- **If assistant (or other person) is in an adjacent room** behind a typical wood or metal and sheetrock wall, the dose will be virtually undetectable: **0 μSv** .

Radiation exposure of clinical staff is relatively small and well below annual exposure limits. However, staff should adhere to the following guidelines:

1. Step out of the operatory, behind a wall or cabinet if possible, and activate x-ray remotely.
2. If you must remain in the operatory, position yourself as far from the x-ray head as possible.
3. Never position yourself in the direct x-ray beam.
4. Numerous other guidelines and clinical instructions can be found in NCRP Report 145 (www.ncrp.com).

Holding a Sensor or Film

If a sensor or film must be manually held in place to ensure proper alignment, the patient should be instructed on how to hold it. If a staff member must hold the sensor, they should shield their hand by using radiation attenuating gloves which are available from multiple sources with high relative cost, but they have not been evaluated by CR.

Lead Aprons and Thyroid Shields

Lead aprons are not *physiologically* necessary for routine intraoral radiographs due to improved x-ray head designs and stringent regulation of leakage radiation, although some local regulations still specify their use. (*See NCRP Report 145, and ADA and BDA statements.*) The apron may be offered as a *psychological* comfort to a patient who desires it, and to children and pregnant women whose tissues are more radiosensitive. Thyroid shields should be used anytime they don't interfere with the image, particularly for children (*see page 4 for example*).

Staff Monitoring with Dosimeters

Dosimeters are required in some locales and situations. Periodic radiation monitoring is helpful to track actual exposure levels, assure staff of safety, and encourage proper practices. Published data show few staff members receive more than 1,000 μSv per year, and most are below the threshold of detection. *Example dosimeter brand: instadose by IC Care, www.iccare.net.*

— Special thanks to Mr. Pete Jenkins of Radiation Safety Consulting Services for his assistance with this study. —

CR Conclusions: Radiation from dental imaging is a minimal portion of a person's annual exposure and poses negligible risk compared to the health benefit. Modern x-ray heads with improved designs have eliminated the need for routine use of lead aprons. Digital sensors and high-speed film have further reduced exposure; clinicians are advised to implement digital radiography. Staff should maintain or implement proper practices and precautions for minimizing exposure. Ionizing radiation must always be used with care, but dental radiation should not be an area of major concern for staff and patients.

Endo Access through Ceramics: Are Cracks a Problem? (Continued from page 1)

CR Endo Access User Survey

When a ceramic restoration must be cut in order to provide endo access, there is an immediate decrease in its overall strength. But how often does this weakening actually result in subsequent restoration failure while in service? Results from a recent CR survey demonstrate some answers to this question and show some notable trends.

CR survey results:

1. Respondents place the following tooth-colored crowns (n=751):

- 98% PFM
- 73% IPS e.max
- 70% Zirconia based
- 67% IPS Empress or clones
- 49% Full zirconia
- 22% Full polymer

2. Percentage of teeth restored with tooth-colored ceramic crowns that required subsequent endo (n=751):

- 0–5% (54% of respondents)
- 6–10% (28%)
- 11–15% (11%)
- 16–20% (5%)
- 21–25% (1%)
- 25% or more (2%)

3. Primary instrument used for endo access (n=751):

- 51% coarse-grit diamond
- 25% carbide bur
- 16% fine-grit diamond
- 8% other

4. How often respondents believe endo access caused subsequent crown fracture:

- 73% IPS Empress or clones (n=503)
- 64% PFM (n=736)
- 54% Zirconia based (n=528)
- 48% IPS e.max (n=549)
- 32% Full polymer (n=160)
- 22% Full zirconia (n=371)

CR Research

To assist clinicians in knowing how to best cut an endo access opening through ceramic materials and also to visualize crack formation, the CR science team performed multiple in vitro experiments. Thin ceramic wafers were prepared from pre-milled ceramic blocks. Wafers were adhered to dentin, and endo access openings of minimal size were cut with a new/unused diamond bur. Project overview and results are summarized below.

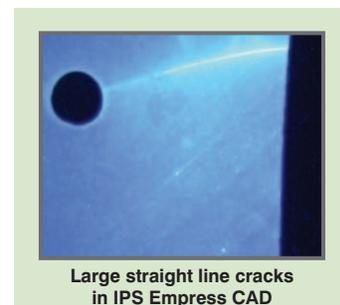
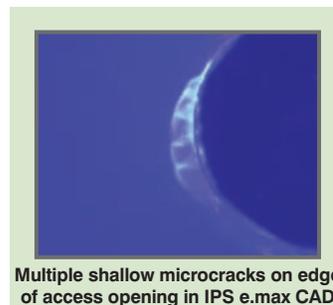
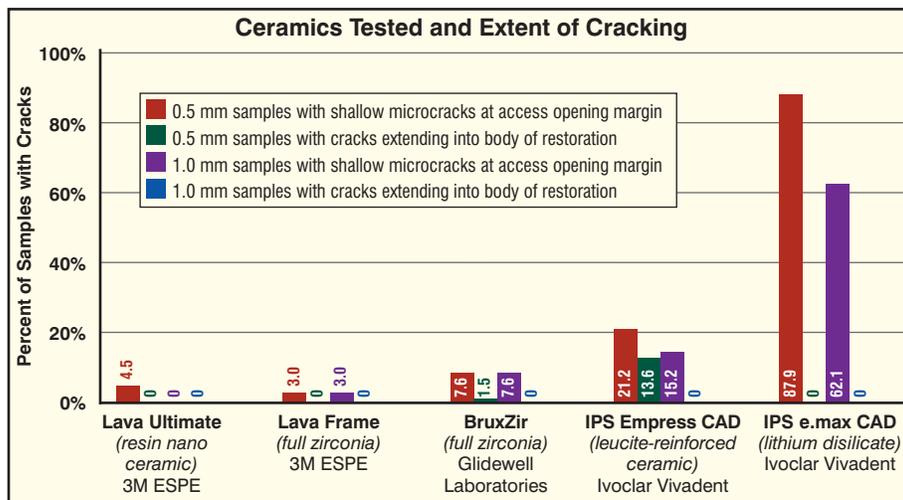
Overview of testing

- Five ceramic materials were tested (see graph at right)
- Wafer thicknesses: 0.5 mm and 1.0 mm
- Average access opening diameter: 1.75 mm
- Diamond burs used were grit and shape recommended by manufacturers (see chart below)
- Clinical technique varied with each bur, per manufacturer instructions of recommended handpiece speed, water flow rate, and hand pressure
- Three methods for visualizing cracks:
 1. Transillumination (Microlux by AdDent Inc.)
 2. Fluorescent dye penetration (Zygo by Magnaflux)
 3. Scanning electron microscopy (SEM)

Experimental Results

- **Effect of ceramic thickness:** 0.5 mm samples were much more likely to crack than 1 mm samples.
- **Effect of ceramic material:** Shallow microcracks were observed in all samples (from most to least): IPS e.max CAD, IPS Empress CAD, BruxZir, Lava Frame, and Lava Ultimate. Cracks extending into body of restoration were most observed in IPS Empress CAD.
- **Effect of diamond bur grit size:** Although studies in literature show fine-grit diamonds to work best for endo access through ceramics, CR testing showed other grits to perform similarly.
- **Effect of diamond bur shape:** Round-ended diamonds generally produced less damage to the ceramic than other bur shapes. Diamond burs tested that were not round ended produced more cracks (not listed below). Diamond dislodgement was more prevalent with burs with a pointed end or sharp edges.

— CR expresses gratitude to Glidewell Laboratories, 3M ESPE, and Ivoclar Vivadent for graciously providing all ceramic samples used for this project. —



Diamond Burs Tested for Making Endodontic Access Opening (Several low-cost brands with similar rounded shape are also available)

Company	Brand	Bur	Grit	Shape	Price/Bur	Minimal Crack Rating†
Horico	Horico Diamond	AUFG001C018	Fine	Round ended	\$4.85*	Excellent
Premier	Two Striper	TSZTECH 125Z	Fine	Round ended	\$10.90*	Excellent
Komet USA	ZR-Diamonds	ZR6801 FG014	Coarse	Round ended	\$11.95*	Excellent
SS White	Great White Z	801-014M	Medium	Round ended	\$7.00*	Excellent–Good
Axis	ZirCut	Z807-018	Z-grit/Fine	Long inverted cone	\$11.40*	Excellent–Good
Brasseler	Dialite Diamond	5021982U0	Fine	Round ended	\$11.95*	Excellent–Good
Microdont	Microdont	1016-001-801	Medium	Round ended	\$1.25	Excellent–Good

* Indicated for multiple use by manufacturer. CR suggests treating these as single-use instruments when performing endo access through ceramics.

† Rating determined by number of large fractures, microcracks, and chips observed.

Endo Access through Ceramics: Are Cracks a Problem? (Continued from page 3)

Clinical Tips

Minimizing need for endo access

- **Ensure tooth vitality** prior to planning for any indirect restorations. If tooth vitality is questionable, accomplish endo *before* crown preparation and cementation.
- **Treating tooth with glutaraldehyde-HEMA** (see *Clinicians Report November 2009*) prior to placing temporary or permanent restorations disinfects and also reduces/eliminates postoperative tooth sensitivity.
- **Provide 1.5 mm or more occlusal/incisal reduction** when cutting tooth preparations. For molars and premolars, it is possible to do this without threatening pulp. This benchmark restoration thickness will make it more resilient against cracking should endo access be needed later.

Cutting the access opening

- **Provide informed consent** to the patient concerning possible risks from both an endo access opening and endodontic treatment, including restoration failure and/or loss of tooth, respectively.
- **Use copious water spray** to lubricate, cool, and clean the bur as you cut.
- **Diamond burs** are more efficient than carbide burs for this procedure and safer because they create less ceramic cracking.
- **Do not reuse burs** since even multiple-use diamonds wear after each use causing a desire to push harder, which risks ceramic cracking and dislodging of diamonds.
- **Use light pressure** allowing the diamonds to do the work. Replace heavy-handedness with circular or swooping hand motions, engaging all available bur cutting surface, to increase cutting speed.
- **Electric handpieces** are a better choice than air-driven handpieces for this procedure because of their superior concentricity. Visually inspect handpieces to ensure concentric motion.

After endo access

- **Check for cracks** in restoration by using either a transillumination device (e.g., *Microlux by AdDent Inc.*) or lighted air-driven handpiece base to shine light into access opening; cracks will appear as dark lines. If cracks are found, inform patient that a complete restoration replacement may be recommended. Not all microcracks are large enough to visualize with transillumination, but this step should not be overlooked.
- **Posts** may or may not be needed, based on clinician's judgment of tooth structure still present.
- **Use a resin-based composite** preceded by optional internal opaquer to fill the access opening. Such restorations may provide lasting strength as well as improved esthetics.
- **Finish and polish restoration** using your normal composite finishing technique.

CR Conclusions: When endodontic treatment appears to be needed, clinicians should accomplish endo *before* seating the crown. When endo access through a ceramic restoration is necessary, proper instrumentation and technique increase the likelihood of long-term restoration structural integrity. Clinicians should accomplish this procedure with new diamond burs, light pressure, and copious irrigation. Making endo access through a restoration thickness of less than 1 mm carries a greater risk of producing microcracks which could propagate during service. Survey and CR research results both showed a trend in glass ceramics (*IPS Empress*) and veneered ceramics (*zirconia based*) being more prone to cracks extending into body of restoration from endo access than monolithic ceramic materials (*BruXZir, Lava Frame, Lava Ultimate, and IPS e.max CAD*).

Noteworthy Products (Continued from page 1)

Lead-Free, Lightweight, Thyroid Collar is as Effective as 0.5 mm Lead Collars

BLOXR Thyroid Collar



\$30/collar (\$360/12 collars)

BLOXR thyroid collars are 50% lighter than lead collars and are made of a novel XPF (*x-ray protection factor*) attenuating material that is as effective as lead. They are comfortable while providing protection of the thyroid area while performing dental radiography. They are made from materials that can be disposed of in a landfill.

Advantages:

- Lightweight
- Easy to place
- Fits well with adjustable Velcro fasteners
- Soft and comfortable for patients
- Did not interfere with intraoral radiographs

Limitation:

- Several Evaluators noted material on outer surface of collar may be difficult to keep clean

BLOXR Corporation

855-256-9729 • www.bloxr.com

CR Conclusions: 81% of 26 CR Evaluators stated they would incorporate BLOXR Thyroid Collar into their practice. 88% rated it excellent or good and worthy of trial by colleagues.

Easy Gingival Retraction with an Astringent Paste Syringed through Very Fine Tip

Retraction Capsule



\$3.16/capsule
(\$79/25 capsules)

Retraction Capsule is a retraction paste (*15% aluminum chloride astringent paste*) provided in small-tipped capsules for fast, accurate placement into the sulcus. Tips of capsules are marked similar to perio probes to view depth of tip insertion. Tissues are mechanically retracted when paste is injected into the sulcus. Leave paste in place for at least two minutes and then completely remove with air/water spray and suction. Capsules may be dispensed with standard resin-based composite capsule dispensers. May be used following placement of initial cord and in place of second cord if more hemostasis is desired.

Advantages:

- Thin tip for easy access into sulcus; easy to dispense
- Good hemostasis
- Paste washes off easily
- Easier to place than cord
- Adequate amount of material in single-use capsule
- Lower cost than some competitors

Limitations:

- Did not provide adequate retraction for *all* retraction needs; cord was still required in some situations
- Bitter flavor was noted by some patients

3M ESPE

800-634-2249 • www.3mespe.com

CR Conclusions: 73% of 22 CR Evaluators stated they would incorporate Retraction Capsule into their practice. 77% rated it excellent or good and worthy of trial by colleagues.

Xerostomia: The No Spit Zone—Causes and Potential Solutions *(Continued from page 1)*

A CR survey generated responses from 656 clinicians on the narrative developed by CR Evaluators and scientists. *The percentages listed below on some topics represent the survey responses.*

1. Function of Saliva

- Buffer acids
- Lubrication
- Digestive enzymes
- Antibiological enzymes
- Aids swallowing
- Remineralize dentition

2. Composition of Normal Saliva

- Enzymes—Antimicrobial: thiocyanate, lysozyme, immunoglobulins, lactoferrin, and transferrin.8; Digestive: ptyalin
- Minerals: Potassium, bicarbonate ions
- Mucin: pH between 6 and 7.1 (*base, anti-acidic*)

3. Signs and Symptoms of Xerostomia

Percentages represent survey respondents opinions on frequency observed

- Increased dental caries87%
- Fluids needed to swallow51%
- Halitosis29%
- Difficulty swallowing dry foods28%
- Difficulty wearing dentures27%
- Burning tongue (*glossodynia*)19%
- Stomatitis13%
- Thirst interrupts sleep12%
- Difficulty talking10%
- Lipstick adhering to teeth (*lipstick sign*)8%
- Candidiasis6%
- Chronic sore throat1%

4. Some Causes of Xerostomia

• Diseases or treatments for disease:

- Sjögren’s auto-immune
- Alzheimer’s
- Anxiety/depression
- Bell’s Palsy
- Crohn’s disease
- Cystic fibrosis
- Diabetes
- HIV
- Hepatitis
- Hypertension
- Scleroderma
- Sarcoidosis
- Rheumatoid arthritis
- Parkinson’s disease

• Medications: 64% of xerostomia episodes are related to medications.

Common medications associated with dry mouth include:
This is only a partial list. See www.CliniciansReport.org for a list of the most prescribed medications associated with xerostomia and a more complete list of 348 medications.

- **Analgesics:** Narcotics, NSAIDS (*Motrin, Celebrex, Naprosyn*), Darvon
- **Antihistamines:** Allegra, Benadryl, Chlor-Trimeton, Claritin, Dimetane, Zyrtec
- **Beta Blockers:** Atenolol, Tenormin, Inderal
- **Bronchodilators:** Albuterol, Proventil, Ventolin, Beclovent, Vancericil, Pulmicort
- **Diuretics:** Dyazide, Lasix
- **GI Acid reducers:** Prevacid, Prilosec, Aciphex, Nexium, belladonna, atropine.
- **Psychotherapeutic:** Adderall, amitriptyline, Effexor, Klonopin, Paxil, Prozac, Risperdal, Tofranil, Valium, Wellbutrin, Xanax, Zoloft, and many more

• Non-pharmacologic:

- Smoking, alcohol, caffeine, mouth breathing
- Winter-time dry heat with mouth breathing sleepers

• Radiation of head and neck

• Advanced age

• Chemotherapy

5. Dental Implications

Listed from most to least in severity per the survey

1. Caries
2. Candidiasis
3. Denture sores (*lack of lubrication*)
4. Periodontal disease
5. Stomatitis

6. Treatment: Trial and Error (*no consensus*)

Percentages are representative of clinicians indicated use from survey

- **Salivary substitutes:** OTC products abound containing lubricating carboxylcellulose/hydroxyethyl cellulose, glycerine products with xylitol/sorbitol, remineralizing calcium and phosphate ions, and some with salivary enzymes and fluoride. However, there are no comparative efficacy studies available. None have the ADA Seal of approval. Most are available as sprays or rinses. The cellulose lubricants are the most common.

– Biotene products:

- Biotene Dry Mouth Kit (*includes sample mouthwash, toothpaste, and gel*)79%
- Biotene Gentle Mouthwash63%
- Biotene Dry Mouth Toothpaste52%
- Biotene Dry Mouth Gum43%
- Biotene Oral Balance Dry Mouth Moisturizing Gel21%

– Commercially available saliva substitutes include:

- Xero-Lube Artificial Saliva (*Scherer*) sodium-free; spray26%
- Saliva Substitute (*Roxane Labs*) liquid22%
- Salivart (*Gebauer*) preservative-free aerosol14%
- Optimoist (*Colgate-Palmolive*) spray13%
- Carboxymethyl, or hydroxyethylcellulose solutions9%
- Moi-Stir (*Kingswood Labs*) spray6%

– Mucopolysaccharide Solutions:

- MouthKote (*Parnell*), spray5%

• Frequently sipping water and sucking on ice

• Night-time humidifier

• Eat foods that require active mastication, e.g., carrots, apples, celery

• Avoid: Antihistamines, decongestants, caffeine, alcohol, commercial mouthwashes containing alcohol

Clinical test for potential efficacy of stimulant therapy:

Spit in cup, measure. Then chew/suck wax, spit in cup, measure. If more saliva is produced, stimulant may work.

• Pharmacological stimulants:

- Only a few survey respondents reported using these*
- Pilocarpine (*Salagen 5mg tid*), cevimeline (*Evoxac, for Sjögren’s, 30mg tid*)
- Contraindications: Uncontrolled asthma; narrow angle glaucoma, iritis. Side effects: nausea, visual disturbances, hypotension, headache, urinary frequency.

• Topical stimulants:

- Xylitol-sweetened mints and gum: Xylishield (*ultradent.com*), Epic (*epicdental.com*), Spry (*xlear.com*)
- Natrol Dry Mouth Relief

7. Preventive Dentistry

See Clinicians Report April 2010: Treating High Risk Caries Patients

- Topical fluorides/remineralizers: custom trays, pastes, gels, and rinses (*by prescription: Clinpro 5000 with tri-calcium phosphate (3M ESPE), PreviDent 5000 products (Colgate), MI Paste/Plus with Recaldent (CPP-ACP) (GC America)*)
- Sub-gingival margins; extension for prevention
- Frequent recalls
- Highly polished restorations
- Fluoride-releasing restorative materials (*glass ionomers*)

CR Conclusions: Xerostomia and its associated complications can contribute to dental disease and the unpleasantness of aging. Radiation, disease-induced salivary hypofunction, and medications are among the causative factors. Recognizing this malady and providing quality preventive measures such as high fluoride toothpastes, fluoride trays, and salivary substitutes/stimulants can provide some protection and relief. Since medications are the primary source of xerostomia, consult with the prescribing clinician to see if it is possible to prescribe a less drying medication.

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