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In-Office Management of Dentin Hypersensitivity

2 CONTINUING EDUCATION CREDITS

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COURSE OBJECTIVES

Upon completion of this course, the participant will be able to:

- Describe what dentin hypersensitivity is
- Explain the etiology and physiology of dental hypersensitivity
- Describe patients at risk for dentinal hypersensitivity
- List the in-o ce and over-the-counter treatment options for the di erent clinical situations of dentinal hypersensitivity

COURSE SPONSOR

Benco Dental is the course sponsor. Benco's ADA/CERP recognition runs from November 2009 through December 2013. Please direct all course questions to the director: Dr. Rick Adelstein, 3401 Richmond Rd., Suite 210, Beachwood, OH 44122. Fax: (216) 595-9300. Phone: (216) 591-1161. email: toothdoc@core.com

SCORING & CREDITS

Upon completion of the course, each participant scoring 80% or better (correctly answering 16 of the 20 questions) will receive a certi cate of completion verifying two Continuing Dental Education Units. e formal continuing education program of this sponsor is accepted by the AGD for FAGD/MAGD credit. Term of acceptance: November 2009 through December 2013. Continuing education credits issued for participation in this CE activity may not apply toward license renewal in all states. It is the responsibility of participants to verify the requirements of their licensing boards.

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e fee for this course is $54.00. If you are not completely satis ed with this course, you may obtain a full refund by contacting Benco Dental in writing: Benco Dental, Attn: Education Department, 295 CenterPoint Boulevard, Pittston, PA 18640

PARTICIPANT COMMENTS

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COURSE ASSESSMENT

Your feedback is important to us. Please complete the brief Course Evaluation survey at the end of your booklet. Your response will help us to better understand your needs so we can tailor future courses accordingly.

WHY TAKE THIS COURSE?

The prevalence of dentin hypersensitivity can be between 4-57% of your patients. Among your periodontal patients, the freqency can be as high as 60-98%. This course examines dentin hypersensitivity and offers effective methods of treatment.

PATIENT CARE—Address the factors that put a patient at risk to dentin hypersensitivity.

CONVENIENCE—Continue your education without traveling, taking time away from work and family, or paying high tuition, registration, and material costs.

CE CREDITS—Successful completion of this course earns you 2 Continuing Dental Education Units.

HIGH QUALITY—Authored for dental professionals, by dental professionals, Dental U® continuing education courses are engaging, concise, and user-friendly.

WHO SHOULD TAKE THIS COURSE?
Dentists, Dental Assistants, and Dental Hygienists.

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Dentin hypersensitivity, also known as tooth sensitivity, root sensitivity, or just sensitivity, is a common patient complaint. Patients describe this phenomena as sharp, short-lasting tooth pain irrespective of the stimulus.(1) Holland and coworkers described dentin hypersensitivity as being "characterized by short, sharp pain arising from exposed dentin in response to stimuli typically thermal, evaporative (air), tactile (rubbing), osmotic or chemical, and which cannot be ascribed to any other form of dental defect of pathology."(2) Clinicians see dentin hypersensitivity as an exaggerated response to routine stimuli to the teeth. Patients respond to dentin hypersensitivity when drying a tooth with an air spray or scratching a tooth with the tip of an explorer. Some patients complain of pain when brushing their teeth or flossing. Although it causes no direct harm to the tooth, dentin or pulp, it has all the criteria to be considered a true pain syndrome.(3) It is important to distinguish sensitivity pain, that of short duration, from pain of longer duration not treatable with desensitizing agents that may be the result of pulpal inflammation.(4) Frequently dentin hypersensitivity is triggered by tooth exposure to cold foods, sweets, beverages, or plaque accumulation on exposed root surfaces. Dentin hypersensitivity has been referred to as one of the most painful and least successfully treated chronic dental conditions of the teeth.(5)

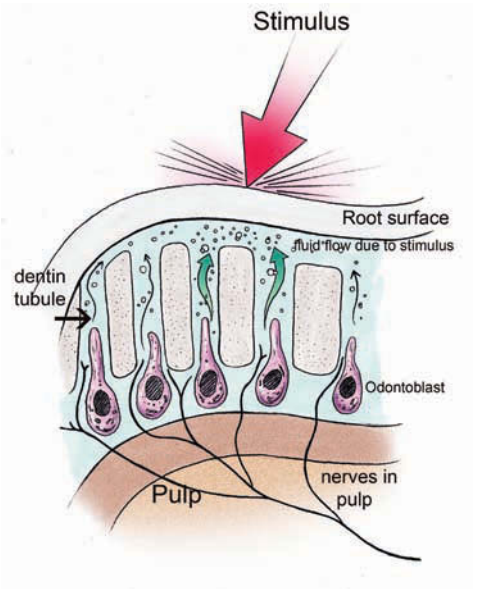

Fig. 1 The hydrodynamic theory describes the aspiration of odontoblasts into the dentinal tubules as an immediate effect of physical stimuli to exposed open ended tubules.

Once a diagnosis has been made, and depending on the etiology of the condition, treatment recommendations can be made that could include in-office, professionally applied treatments, at-home, professionally dispensed treatments or recommendations for over-the-counter treatments.(6) No matter what treatment recommendations are made and provided, it is important for the clinician to follow-up with the patient to evaluate the therapeutic results of treatment recommendations.

A number of studies have evaluated the prevalence of dentin hypersensitivity. The prevalence of dentinal hypersensitivity has been reported between 4% and 57% in the general population.(7-10) Among periodontal patients, the frequency of tooth hypersensitivity is considerably higher (60% - 98%).(11,12) Of interest, patients that have dentin hypersensitivity may not specifically seek treatment because they do not view it as a significant dental health problem, but will mention it at a routine dental appointment.(13) Both men and woman are affected by dentin hypersensitivity, although women may be affected more often.(14) Root sensitivity has been reported on incisors, canines, premolars and molars although it has been reported to more often affect canines and premolars.(15)

ETIOLOGY AND PHYSIOLOGY OF DENTINAL HYPERSENSITIVITY

Dentin is a porous, mineralized connective tissue with an organic matrix of collagenous proteins and an inorganic component, hydroxyapaptite. Dentin contains a microscopic structure called dentinal tubules, which are micro-canals that radiate outward through the dentin from the pulp cavity to the surface cementum border. These canals have different configurations and diameters in different teeth. For human dentin, one square millimeter of dentin can contain 30,000 tubules, depending on depth. Each tubule contains a Tomes fiber (cytoplastic cell process) and an odontoblast that communicates with the pulp. Within the dentinal tubules there are two types of nerve fibers, myelinated (A-fibers) and unmyelinated (C- fibers).(16) The A- fibers are responsible for the sensation of dentinal hypersensitivity.

The most widely accepted mechanism of dentin sensitivity is the hydrodynamic theory, first described by Brännström.(17) In this model, the aspiration of odontoblasts into the dentinal tubules as an immediate effect of physical stimuli applied to exposed dentin results in the outward flow of the tubular contents (dentinal fluids) through capillary action. (Fig. 1) The changes to the dentinal surface due to the physical stimulus lead to stimulation of the A-type nerve fibers surrounding the odontoblasts. For there to be a stimulus-response, the tubules must be open at both ends (the dentinal interface and within the pulp.) It has been reported that non-sensitive teeth have fewer exposed dentinal tubules than sensitive teeth.(18)

LOCATION OF DENTIN HYPERSENSITIVITY—PATIENTS AT RISK

Why are some root surfaces hypersensitive and others are not? When attrition (tooth wear) is present with ex-

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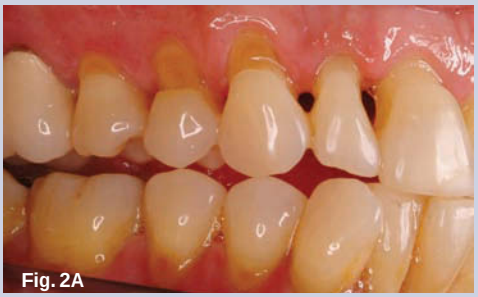
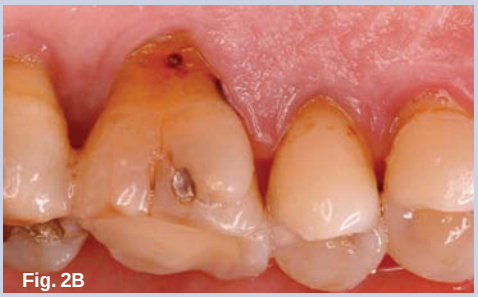


Fig. 2A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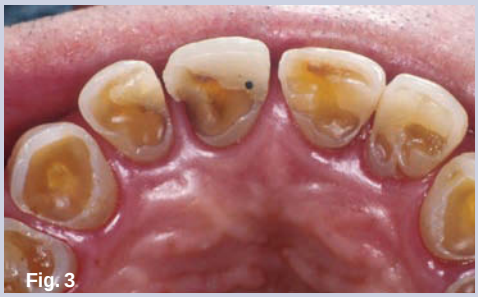
Fig. 3

Fig. 2 Gingival recession with exposed root surfaces are susceptible to dentinal hypersensitivity: **2A** Example of exposed facial root surfaces; **2B** Example of exposed lingual surfaces. **Fig. 3** Example of enamel loss with exposed dentin due to tooth attrition. The exposed dentin can exhibit dentin hypersensitivity.

posed dentin on the occlusal surfaces, the dentin may or may not be sensitive. Clinically, patients are concerned whenever there is dental pain. For some patients the discomfort of dentin hypersensitivity is only a minor problem. For others, it is a constant recurring condition that is typically a chronic painful episode that can lead to emotional distress. Patients can identify areas of dentin hypersensitivity before a clinical exam is performed. If dentin hypersensitivity is present during a clinical examination through the blowing air on a tooth or by scratching during a tactile exam of hard tooth surfaces, but the patient has not described tooth sensitivity as a concern, there is no need to treat the condition. Treatment is generated by patient request a er consultation.

Exposed root surfaces due to gingival recession are a major predisposing factor to dentinal root hypersensitivity. (Fig. 2)[14] Enamel loss with exposed dentin due to attrition and tooth wear due to bruxism, occlusal habits, and other forms of parafunctional activity can also contribute to the etiology of dentin hypersensitivity. (Fig. 3)

A study concluded at least 22% of the adult population between 30 and 90 years of age will have evidence of recession of 3 mm or more in one or more teeth.[19] e prevalence of root sensitivity has been reported as 9-23% before and 54-55% a er periodontal therapy (scaling and root planing and periodontal surgery).[20]

Gingival recession is a predisposing factor to dentin hypersensitivity, not a direct cause.[14] With the root surfaces exposed to the oral environment, the dentin tubules must be opened at both ends, to the pulp and oral cavity, for a patient to have the symptoms of dentin hypersensitivity. In normal function, the tubules sclerose and become plugged. However, when dentin is cut or abraded, the mineralized matrix produces debris that spreads over the dentin surface to form a smear layer.[24] is phenomenon occurs to both enamel and dentin, but the loss of this smear layer, the unplugging of the dentinal tubules, contributes to dentinal hypersensitivity. Root surfaces exposed to the physical action of toothbrushing with and without toothpaste can be predisposing factors in removing the smear layer leaving a tooth hypersensitive.[22] e opening of dentinal tubules can also occur due to poor oral hygiene techniques leaving bacterial plaque on root surfaces. e acidic byproducts of the plaque can open the dentinal tubules. Also, excellent oral hygiene techniques with highly abrasive dentifrices can cause continued dentinal tubule exposure. Another at-risk behavior is the exposure of the oral cavity to acids, e.g., ingestion of acidic foods and beverages[23, 24], ingestion of chlorinated pool water.[25] Bulimia and gastrointestinal re ux disease can also contribute to the opening of the end of the dentinal tubules.[26] Brushing immediately a er ingesting acidic foods or beverages should be avoided.

SCREENING AND DIAGNOSIS OF DENTIN HYPERSENSITIVITY

How e ective are dental professionals in the screening, diagnosis and treatment of dentin hypersensitivity? Unfortunately, dentists and dental hygienists do not routinely include screening for dentinal hypersensitivity unless the symptoms are brought to their attention by the patient.[27]

A questionnaire mailed to 5,000 dentists and 3,000 dental hygienists in Canada to evaluate a practitioners' understanding and clinical management of dentin hypersensitivity revealed some startling facts.[27] Of the

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TABLE 1: DIAGNOSIS DENTIN HYPERSENSITIVITY

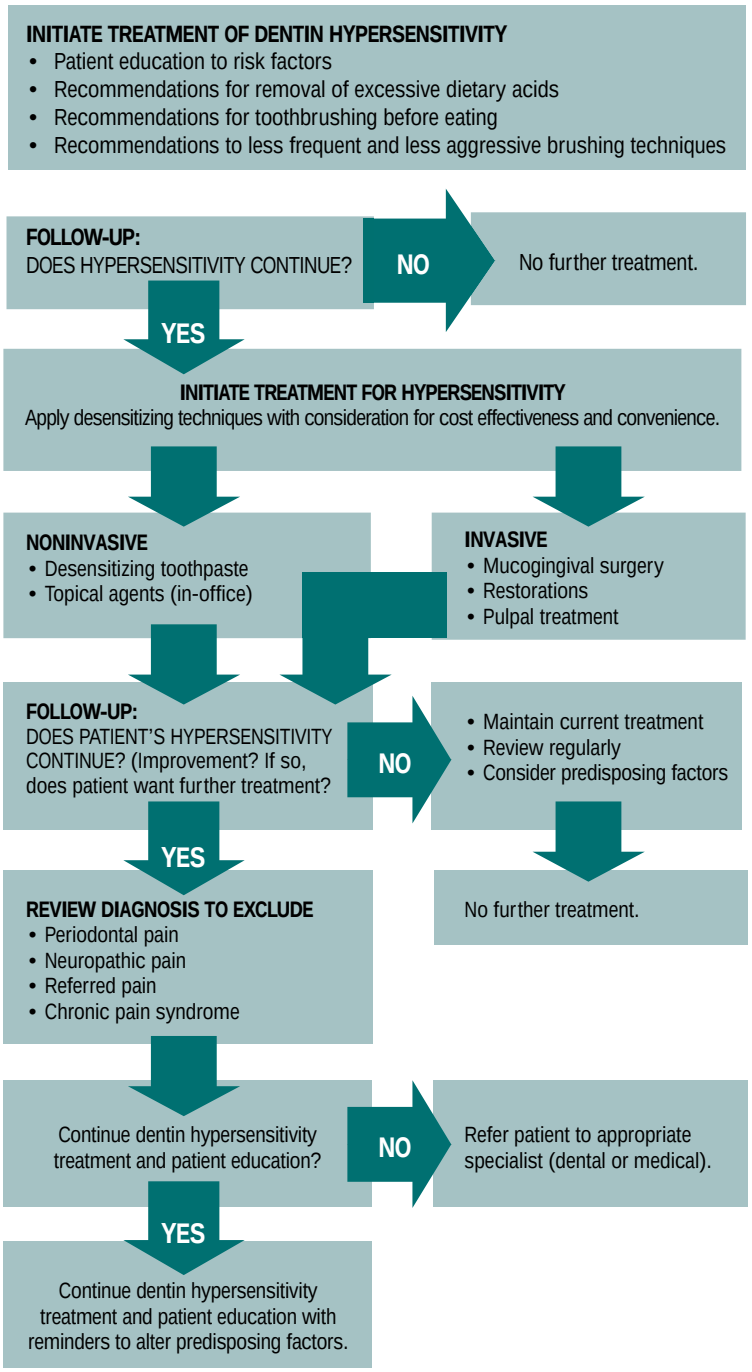

Table 1 Flow chart for treatment of dentin hypersensitivity (adapted from Canadian Advisory Board on Dentin Hypersensitivity. Consensus-based recommendations for the diagnosis and management of dentin hypersensitivity 2003; J Can Dent Assoc 69:221-226)

respondents to the survey, fewer than half considered a di erential diagnosis, even though dentin hypersensitivity is by de nition a diagnosis of exclusion. Many of those responding to the survey misidenti ed the etiology with 64% of the dentists and 77% of the hygienists identifed bruxism and malocclusion as triggers of dentin hypersensitivity, even though there is no evidence these have been identi ed as a major cause. More troubling is only 7% of dentists and 5% of dental hygienists correctly identi ed erosion as a primary cause of dentin hypersensitivity. Further, 17% of dentists and 48% of hygienists were not able to identify the accepted theory of hypersensitivity.

In this same survey, the management of dentin hypersensitivity was evaluated. Only half of the respondents to the survey on hypersensitivity had the con dence to manage a patient's pain with only 50% considering the modi cation of predisposing factors to control a patient's pain.

is survey also demonstrated a lack of understanding for the mechanisms for desensitizing teeth with desensitizing toothpastes. e lack of knowledge on the action and treatment of dentinal hypersensitivity was demonstrated when most dentists (56%) and dental hygienists (68%) believed desensitizing toothpastes helped prevent dentin hypersensitivity, while 31% of dentists and 16% of hygienists did not believe desensitizing toothpastes relieved dentin hypersensitivity.

Dental professionals need to be better educated on the etiology and treatment of dentin hypersensitivity. As part of any screening for dentin hypersensitivity, the clinician should assess whether there is a localized or generalized problem. Localized isolated tooth dentin hypersensitivity can usually be treated with in-o ce treatments. For generalized conditions where there is signi cant recession on multiple teeth, an at-home treatment regimen may be a better choice.

TREATMENT OF DENTINAL HYPERSENSITIVITY

Once the diagnosis of dentinal hypersensitivity has been made and the etiologic factors identified, a treatment plan can be developed and implemented. [27] (Table 1)

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Drisko summarized preventive recommendations for dentinal hypersensitivity: [28]

Suggestions for patients:

- Avoid gingival recession due to poor plaque removal;
- Avoid using large amounts of dentifrice or reapplying it during brushing;
- Avoid medium or hard bristle toothbrushes;
- Avoid brushing teeth immediately a er the ingestion of acidic foods;
- Avoid overbrushing with excessive pressure or for an extended period of time;
- Avoid excessive ossing or improper use of other interproximal cleaning devices;
- Avoid 'picking' or scratching at the gumline or using toothpicks inappropriately.

Suggestions for professionals:

- Avoid over-instrumenting the root surfaces during scaling and root planing, particularly in the cervical area of the tooth;
- Avoid over-polishing exposed dentin during stain removal;
- Avoid violating the biologic width during restoration placement as this may cause recession;
- Avoid burning the gingival tissues during in-o ce bleaching and advise patients to be careful when using home bleaching products.

Over-the-counter desensitizing toothpastes

Root sensitivity is well recognized by the general population as an oral condition that they can treat themselves. Over-the-counter (OTC) treatments for sensitive teeth, usually in the form of toothpastes, are a major category of dentifrice. Since the use of an OTC product can be the most cost-e ective means for a patient to receive care, many people make the decision to self medicate with desensitizing toothpastes.

What are desensitizing toothpastes, and do they work?

Dentifrices claiming a desensitization e ect come under scrutiny from the Federal Drug Administration. e claim of desensitizing teeth is a therapeutic claim that must be substantiated by either clinical trials or the addition of an ingredient to the toothpaste that is recognized as being an e ective, active agent for the treatment of the condition listed. e most popular ingredient for desensitizing in toothpastes is potassium nitrate. According to the FDA monograph, for a toothpaste to claim to be desensitizing, they need to contain 5% potassium nitrate as an active ingredient.[29] e mode of action of a 5% potassium nitrate has been described as a penetration of the potassium ions through the tubules to the A- bers of the nerves, decreasing the excitability of these nerves. [30, 31]

PROFESSIONAL IN-OFFICE TREATMENT OF DENTINAL HYPERSENSITIVITY

Since gingival recession and exposed root surfaces are major predisposing factors to dentin hypersensitivity, gingival gra s should be considered as part of a treatment plan, particularly when the recession is progressive, there are aesthetic concerns, or the sensitivity is unresponsive to more conservative treatment.[32, 33] When the exposed sensitive root surface has surface loss due to abrasion, erosion, and/or abfraction leaving a notching of the root, consideration should be given to placing either an adhesive composite resin or glass ionomer restoration.[34] ese restorations will both restore the tooth to full contour and seal the exposed and open dentinal tubules.

Another major dentin hypersensivity issue is the patient having a scaling and/or root planing and a dental prophylaxis. In many cases, a er a dental cleaning, the dentin hypersensitivity is heightened. For these patients, rapid, immediate relief is desired. Recently, Colgate introduced desensitizing paste, Colgate Sensitive Pro-relief for in-of-ce application to reduce post-operative dentin hypersensitivity a er routine dental cleanings. While not yet

TABLE 2: PAINT-ON DESENSITIZING AGENTS

GLUTARALDEHYDE BASED	
Calm-It	Dentsply Caulk
Gluma	Heraeus Kulzer
G5	Clinician's Choice
MicroPrime G	Danville Engineering
NON-GLUTARALDEHYDE BASED	
Oxalate based	
D/Sense	Centrix
D/Sense 2	Centrix
Bisblock	Bisco
Disinfectant	
HemaSeal and Cide (chlorhexidine)	Advantage
Hurriseal (benzalKonium chloride)	Beutilich
Resin based	
Seal and Protect	Dentsply Caulk
Any self-etch adhesive	
Any fluoride varnish	

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available in the United States, we will be seeing this product in the near future. is new in-o ce desensitizing paste contains 8% arginine and calcium carbonate. e mode of action mimics the chemical reactivity of saliva in carrying calcium and phosphate ions for deposition on the dentin and root surfaces, gradually causing open dentinal tubule occlusion. e mix of arginine and calcium carbonate work synergistically with the calcium and phosphate in the oral environment, using a similar mode of action to that of saliva, but in a signi cantly more rapid deposition and e ective clogging of the tubules. is results in the creation of a dentin plug that resists normal pulpal pressures and acid attack, leading to a desensitizing e ect. Two studies have demonstrated that application of this desensitizing paste prior to a professional dental cleaning was e ective, providing patients with relief from the active treatment over a period of four weeks a er scaling and root planing[35] and was e ective as a sensitivity preventive applied prior to a dental prophylaxis.[36] is novel desensitizing formulation provided statistically signi cant reductions in dental hypersensitivity following the procedure when compared to the control.

In-o ce, paint-on surface treatments are a more popular approach to treating root hypersensitivity. (Table 2) ese are especially e ective when localized conditions (single teeth) demonstrate dentin hypersensitivity. Coding for dental insurance for the in-o ce treatment of dentin hypersensitivity is under miscellaneous services. (Table 3) A variety of products have been reported to be used to successfully reduce dentinal hypersensitivity. ese products generally occlude and seal the dentin tubules. Resin-based materials have been reported to successfully reduce dentin hypersensitivity.[37, 38] With the expanded use of uoride varnish, they have become more popular to seal exposed root surfaces and reduce hypersensitivity. Use of a 5% sodium uoride varnish painted over exposed root surfaces has been shown to be an e ective treatment of dentin hypersensitivity.[39] An aqueous solution of glutaraldehyde and HEMA (hydroxyethylmethacrylate) e.g., Gluma Desensitizer (Hereaus-Kulzer) and Calm-It (Dentsply-Caulk), has been reported to be an e ective desensitizing agent for up to nine months.[38, 40] e mechansim for tubule occlusion appears to be due to the glutaraldehyde e ects.[41]

Using paint-on desensitizers are an excellent treatment of individual teeth. The clinical technique for the use glutaraldehyde desensitizers requires the tooth be clean and dry. (Fig. 4) Since the tooth is sensitive, dry the tooth using a blotting technique with a cotton roll. (Fig. 5) For the Calm-It desensitizer, it is recommended that the desensitizing liquid be applied for 30-60 seconds using a gentle rubbing motion, keeping the root surfaces wet with the desensitizing agent. (Fig. 6) After application, using a very gentle air spray, blow off most of the excess but leave the surface wet. Using the air spray will demonstrate to the patient that there is a reduction in sensitivity. For most patients, I have them continue using a desensitizing toothpaste for the next month. Glutaraldehyde desensitizing agents have also been shown to help reduce post-operative sensitivity with composite resin restorations that have used etch and rinse (total etch) adhesives. After etching, rinsing and drying, the glutaraldehyde desensitizer is applied for 30-60 seconds with gentle rubbing (Fig. 7), dried from the cavity preparation and the adhesive applied before the composite restoration. Glutaraldehyde desensitizers can also be used with glass ionomer restorations.

Other techniques include paint-on oxalate based desensitizers and lasers. The use of oxalates for the treatment of dentin hypersensitivity has been shown to be effective.[4, 42] The oxalate precipitates on the open dentinal tubules, occluding them. This action reduces

TABLE 3:
ADA INSURANCE CODES FOR IN-OFFICE APPLICATION OF DESENSITIZING AGENTS MISCELLANEOUS SERVICES

D9910	**Application of desensitizing medicament** Includes in-office treatment of root sensitivity. Typically reported on a "per visit" basis for application of topical fluoride or other desensitizing agents. This code is not used for bases, liners or adhesives used under restorations.
D9911	**Application of desensitizing resin for cervical and/or root surface** Typically reported on a "per tooth" basis for application of adhesive resins. This code is not used for bases, liners or adhesives used under restorations.

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patient perception of pain to external stimuli. An oxalate desensitizer with potassium nitrate (D/Sense, Centrix, Shelton, CT) has been shown to be an e ective desensitizer.[42] is product occludes open dentinal tubules combined with the desensitizing e ect of potassium nitrate. Oxalate desensitizers are not compatible with resin or glass ionomer adhesive techniques. Lasers have also been used successfully to seal open dentinal tubules either by themselves or with surface treatments with other materials.[43, 44]

Recommendations for in-o ce techniques and indications for their use are product-speci c. e clinician needs to understand the di erent techniques before employing them in the treatment of dentin hypersensitivity for their patients. ere will be times a restorative intervention will be necessary. When the root surface is exposed with the presence of notching, the depth and size of the notching will in some cases require the placement of a restoration.[34]

Dentin hypersensitivity has also been reported as a post-operative symptom following restorative treatment. is sensitivity is usually associated with routine xed prosthodontic treatment during preparation, impressions, and temporization. In fact, most astrigidents used for gingival retraction are acidic and remove the smear layer, leaving open dentinal tubules. Post-operative sensitivity a er the placement of posterior composite resins is the same as dentinal hypersensitivity. Preventive treatment to avoid having postoperative sensitivity would involve using the same paint-on desensitizing agents used for the treatment of exposed root surfaces.

CONCLUSION

Dental professionals need to understand the causes of dentin hypersensitivity. A patient should be evaluated based upon risk factors that may be present. Once a diagnosis has been made and the factors have been identi ed a treatment plan can be outlined to the patient for the treatment of dentin hypersensitivity. As part of the routine dental examination, dental professionals should include in their patient questions during every recall appointment whether there are any sensitive teeth. Depending on severity of the condition, clinical management of dentin hypersensitivity may include both in-o ce and self-applied at-home therapies. In most circumstances, the least invasive, most cost-e ective treatment is the recommendation to use an e ective toothpaste that provides desensitizing e ects. For individual teeth that are hypersensitive, an in-o ce treatment can provide the patient with pain relief. Once a tooth is predisposed to dentin hypersensitivity it will need to be reevaluated for continued at-home treatment.

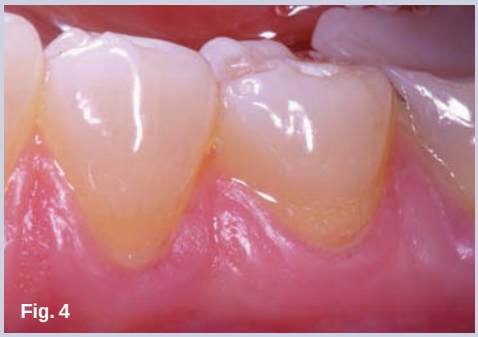
Fig. 4

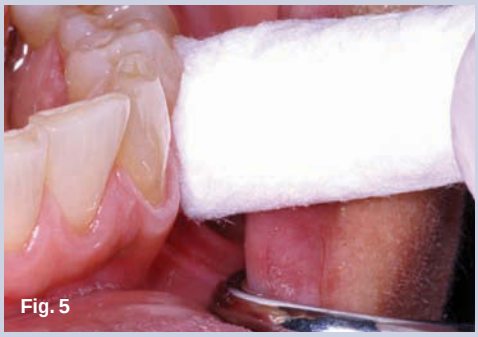
Fig. 5


Fig. 6


Fig. 7

Fig. 4 Exposed root surfaces with patient chief complaint of root sensitivity. **Fig. 5** Drying root surface by blotting with cotton roll. **Fig. 6** Application of Calm-It glutaraldehye-based desensitizer by gently rubbing on root surface for 30-60 seconds. **Fig. 7** Application of Calm-It unit dose to Class II cavity preparation after acid etching before placement of adhesive and composite resin.

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CUT ALONG DOTTED LINE

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1. Dentin hypersensitivity (tooth sensitivity or root sensitivity) can be characterized by patients as:

a. a dull, throbbing pain
b. a low grade, hot response
c. a sharp, short lasting pain
d. a long lasting, spontaneous, intermittent pain

2. Stimuli that can cause dentin hypersensitivity pain can be:

a. thermal
b. evaporative (air)
c. tactile
d. osmotic
e. all the above

3. Patients with dentin hypersensitivity complain of pain when the teeth are exposed to air, or scratching on the tooth surface with an explorer and in some cases pain when brushing or flossing their teeth.

a. True
b. False

4. The frequency of dentin hypersensitivity for the general population has been reported as between:

a. 1-5%
b. 4-57%
c. 65-75%
d. 85-95%

5. Among periodontal patients, the prevalence of dentin hypersensitivity is considerably higher than the general population with frequencies of:

a. 15-20%
b. 25-37%
c. 32-46%
d. 60-98%

6. Root sensitivity has been reported on incisors, canines, premolars and molars although it has been reported to more often affect canines and premolars.

a. True
b. False

7. Dentin contains a microscopic structure called dentinal tubules which are micro-canals that radiate outward through the dentin from the pulp cavity to the surface cementum border. These canals have different configurations and diameters in different teeth. For human dentin, one square millimeter of dentin can contain _____ tubules depending on depth.

a. 250
b. 1000
c. 5000
d. 30,000

8. What type of nerve fibers within the dentinal tubules are responsible for dentinal hypersensitivity?

a. A- fibers
b. Omega fibers
c. Delta fibers
d. Z- fibers

9. The most widely accepted mechanism of dentin sensitivity was first described by what researcher?

a. Bowen
b. Brännström
c. Beaverton
d. Pauling

10. The mechanism that is generally accepted as the cause of dentinal hypersensitivity is the:

a. plasticizing theory
b. hydrodynamic theory
c. distalizing theory
d. flexural root surface theory

11. What is a major predisposing factor to dentinal hypersensitivity?
a. acidic diet
b. recession with exposed root surfaces
c. caries
d. lack of uoride toothpaste

12. What other condition(s) can contribute to the etiology of dentin hypersensitivity?
a. Enamel loss due to attrition
b. Tooth loss due to bruxism
c. Tooth loss due to parafunctional habits
d. All can contribute to dentin hypersensitivity.

13. e prevalence of root sensitivity can increase in intensity a er periodontal therapy (root planing and periodontal surgery).
a. True
b. False

14. According to a questionnaire mailed to approximately 5,000 dentists and 3,000 hygienists in Canada, dental professionals misidenti ed the etiology of dentin hypersensitivity what percentage of the time?
a. 25% of the dentists and 33% of the hygienists
b. 32% of the dentists and 18% of the hygienists
c. 44% of the dentists and 53% of the hygienists
d. 64% of the dentists and 77% of the hygienists

15. Over-the counter toothpastes for treating dentinal (root) sensitivity can make the therapeutic claim because they contain what active ingredient?
a. 5% potassium nitrate
b. 25% hydrated sodium chloride
c. 10% carbamide peroxide
d. 14% sodium perborate

16. e active ingredient in over-the-counter toothpastes for treating dentinal (root) sensitivity mode of action has been described as:
a. penetrates to the odontoblastic processes and chemically cauterizes the nerve endings.
b. penetration of the potassium ions through the tubules to the A- bers descreasing the excitability of these nerves.
c. an osmotic gradient that attracts the pellicle to seal the tubules.
d. the sodium in the active agent creates a rapid nerve excitation followed by a long duration inhibitory phase.

17. A restorative treatment of exposed root surfaces with dentinal (root) hypersensitivity would be the placement of an adhesive composite or glass ionomer.
a. True
b. False

18. One of the most popular and successful paint-on, professionally applied desensitizing agents contains an aqueous solution of glutaraldehyde and HEMA. e mechanism of action is theorized as:
a. the glutaraldehyde occludes the dentinal tubules.
b. the HEMA reduces nerve excitability
c. the glutaraldehyde attracts calcium ions in the saliva depolarizing the odontoblastic processes.
d. the HEMA works synergistically with uoride in toothpastes and mouthrinses.

19. Glutaraldehyde paint-on, professionally applied desensitizing agents are compatible with composite resin adhesives, resin cementation, and glass ionomer cementation.
a. True
b. False

20. Oxalate-based, paint-on, professionally applied desensitizing agents are compatible with composite resin adhesives, resin cementation, and glass ionomer cementation.
a. True
b. False

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2. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
3. Ⓐ Ⓑ
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