Second Edition

Quality Resource Guide

Management of the Patient with Dentin Hypersensitivity

Author Acknowledgements

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Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Understand the cause and the common contributing factors of dentinal hypersensitivity.
2. Recognize the clinical symptoms of dentin hypersensitivity.
3. Discuss common diagnostic tools and describe clinical tests to distinguish between dentin hypersensitivity and other oral pain.
4. Describe the treatment options for dentin hypersensitivity.
5. List different desensitizing products in the market and evidence-based treatment approaches used for at-home and in-office treatment of dentin hypersensitivity.

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Introduction

Dentin hypersensitivity should be considered a quality-of-life issue, impacting a significant number of individuals. Left untreated, it creates suffering for the patient and a risk for further deterioration of tooth structure. Dental professionals who provide effective treatment for dentin hypersensitivity, and focus on providing dental experiences customized to each patient, have a better chance to develop strong patient relationships resulting in higher patient satisfaction, increased case acceptance, fewer cancellations, and more referrals. This Quality Resource Guide will discuss the mechanism and contributing factors for dentin hypersensitivity, and effective methods to manage sequelae.

What is Tooth Sensitivity?

Dentin hypersensitivity is a short sharp pain with fast onset, either localized or generalized, originating from exposed dentin in response to stimuli (thermal, evaporative, tactile, osmotic, or chemical). It is not connected to any other dental defect or pathology.[1,2]

Incidence of Dentin Hypersensitivity

Dentin hypersensitivity is a global oral health issue and a significant challenge for dental professionals. Dentinal hypersensitivity is under-reported by dental patients and underdiagnosed by dental providers. Studies show that dentin hypersensitivity is a problem that affects mainly the adult population, with 25%-46% of 18-70 year olds experiencing symptoms.[3,4] Dentin hypersensitivity peaks in 20 to 30 year olds, and then rises again when individuals are in their 50s.

Theories of Causation

Throughout the years, the mechanism of dentinal hypersensitivity has been explained by several theories: the modulation theory, the transducer theory, the "gate" control and vibration theory, and the hydrodynamic theory.[5,6] The "hydrodynamic theory", proposed in the 1960s, continues to be the most widely accepted mechanism. This theory asserts that fluid within the dentinal tubules moves when the exposed dentin is disturbed by chemical, thermal, tactile or evaporative stimuli. The movement of fluid leads to instant stimulation of mechanical receptors that are sensitive to fluid pressure, causing transmission of a neural response to the pulp tissue and a pain response.[6] Berman, in 1985, described this reaction: "The coefficient of thermal expansion of the tubule fluid is about ten times that of the tubule wall. Therefore, heat applied to dentin will result in expansion of the dentinal fluid, and a cold stimulus will result in contraction of the fluid, both creating an excitation of the 'mechano-receptor'".[5]

In a patient with dentinal hypersensitivity, dentinal tubules are open at the external dentin surface and at the pulpal surface. Anatomically, tubules widen as they approach the pulp chamber, and tubules per unit area are increased almost two-fold at the pulp chamber compared to the external dentin surface.[7] The most influential factor affecting fluid flow in dentin is the radius of the dentinal tubules. If the radius of a tubule is reduced by one-half, the fluid flow within it falls to one-sixteenth of its original rate. Based on this, the creating a smear layer or the occlusion of the tubules will significantly reduce sensitivity.[8,9]

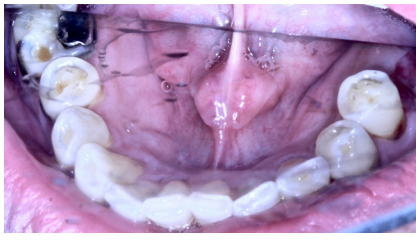
Contributing Factors for Dentin Hypersensitivity

Over 90% of tooth surfaces with dentin hypersensitivity involve facial root surfaces near the gingival margin, commonly in premolars and canines. Injury is typically due to loss of enamel or gingival recession exposing a root surface with eroded cementum.[10] This leads to exposure of dentinal tubules, which lead to sensitivity when teeth are exposed to different stimuli such as air pressure/cold air, hot or cold food or drink, high levels of acidity in drinks or food, or sugar. Among the specific contributing factors for dentin sensitivity are:

- **Loss of gingival attachment** in a patient with periodontitis that manifests gingival recession and exposed dentin.
- **Exposed dentin and/or loss of cementum** following periodontal therapy (scaling and root planing or surgical treatment)[11] A systematic review reported that the prevalence of dentin hypersensitivity after periodontal treatment was 54-55%, with intensity the of the dentinal hypersensitivity peaking between the 1st and the 8th week post-treatment.[12]
- **Gingival recession and loss of cementum** due to: improper brushing habits (brushing too hard or using an abrasive toothpaste); chronic exposure to bacterial plaque; gingival laceration from oral habits such as toothpick use; excessive flossing; crown preparation; inadequate attached gingiva; or an inadequate labial plate of the alveolar bone.[6]
- **Erosion** (**Figure 1**) may be caused by a highly acidic diet and can result in loss of enamel and exposure of dentin. Erosion is often a result of excessive intake of dietary acids such as alcoholic beverages, carbonated soft drinks, citrus juices and fruits and fried foods.[13,14] Dental providers should be aware that other foods such as barley, soybean and sweetened yogurt, are also highly acidic. (**Figure 2**)

Figure 1 - Tooth Erosion

Figure 3 - Tooth Abrasion (Bruxism)



- **Grinding** (Bruxism) - Bruxism is tooth abrasion caused by excessive teeth grinding (which may occur during the day or at night), resulting in dentin exposure. (**Figure 3**)

Diagnosis

Dentin hypersensitivity is a commonly mis-diagnosed and improperly treated clinical condition. Its symptoms are challenging to diagnose accurately because they are generally reported by the patient and are difficult to describe. The challenge to diagnose dentin hypersensitivity comes from the fact that other dental diseases, such as dental caries, cracked-tooth syndrome, and defective restorations, may have similar clinical symptomology and need to be ruled out as the etiology.[1,15]

Patients with dentin hypersensitivity desire to be free from pain and discomfort, but in most cases, they may find it hard to describe specific clinical symptoms. Undiagnosed or untreated dentin hypersensitivity can create barriers to effective dental visits and could lead to a gradual loss of trust and communication between the patient and the office. Clinicians may miss valuable diagnostic clues when they are indifferent to vague symptoms or do not take the time to establish a dialogue with the patient regarding their concerns. If the dental professional shows concern about comfort, patients may be more willing to participate in a dialogue leading to effective diagnosis and treatment.

What are the Classic Symptoms of Dentin Hypersensitivity?

The most common symptom reported is a sudden, sharp transient pain. There are not usually any additional symptoms and the symptoms quickly subside when stimulation subsides.[15]

How to Diagnose Dentin Hypersensitivity?

A comprehensive dental examination should be carried out, including a detailed dietary history and analysis. The dietary history will assist in identifying the risk factors the patient may have. Useful diagnostic tools that the dentist should use are the dental explorer (touch), air/water syringe or ice (thermal), percussion testing, bite stress tests, and assessment of occlusion. Appropriate radiographic evidence is also important.[16] The most important concept to remember is that dentinal hypersensitivity is typically diagnosed by exclusion.

Figure 2 - Acidic Foods

Courtesy of: www.mindbodygreen.com

Differential Diagnosis

The dentist should rule out other underlying conditions for which sensitivity may be a symptom, such as: cracked tooth; chipped teeth; dental caries; fractured restoration; marginal leakage; gingival inflammation; post-restorative sensitivity; and pulpitis. Some patients may experience sensitive teeth symptoms when they have a common cold or sinus infection. Maxillary sinuses and the maxillary posterior teeth share common nerves; inflammation of the sinus can cause pain in the teeth. In this situation, the patient doesn't have exposed dentin.[15,16]

Teeth sensitive to hot temperatures may indicate pulpal involvement requiring root canal treatment. Usually, teeth with dentin hypersensitivity elicit a sharp, sudden transient pain when contacted with cold temperatures. Cold is usually a better indicator of dentin hypersensitivity than hot.[15]

If cold sensitivity is reported by the patient to be concentrated on only one tooth it could be because his/her occlusion needs assessment. Another possibility could be a "leaky" restoration. Proper diagnostic x-rays together with visual and tactile diagnosis should be carried out to rule out these possibilities.[15,16]

Management of Dentin Hypersensitivity

Prevention of Dentin Hypersensitivity

The basic preventive measures for dentin hypersensitivity should be provided at home and/or in the dental office. At-home measures are basically identical to those tailored for patients with dental erosion. The patient should avoid erosive (highly acidic) drinks and diet and execute gentle but efficient tooth brushing with a soft brush and low abrasive toothpaste. Practice guidelines for specific techniques have not been established as there are no systematic reviews covering nutritional counseling or oral hygiene approaches for dentin hypersensitivity.[1]

Dental professionals may reduce the risk of causing tooth sensitivity by avoiding multiple in-office prolonged bleaching sessions with highly concentrated hydrogen peroxide products and by assuring that restorative margins are sealed. Preventive fluoride varnish applications should be a routine practice following periodontal treatment involving root instrumentation.

Treatment of Dentin Hypersensitivity

"Can you replace tooth enamel?" is a common question asked by patients suffering from dentin hypersensitivity when they learn from their dentist that the reason behind their pain is the exposed dentin due to enamel loss. The answer to this question is "unfortunately no"; tooth enamel has no living cells and cannot repair itself.

There are two main approaches reported in the literature to treat hypersensitive teeth: 1) blocking the exposed dentin tubules to prevent fluid movement with currently available desensitizing agents or devices (fluoride varnishes, dentin bonding agents, oxalate gels, laser therapy and protein precipitation) and; 2) inhibition of the neuronal transmission of the stimuli.[17] Potassium nitrate is typically the agent to provide this action. As far back as 1935, Grossman mentioned that the ideal desensitizing agent should be: rapidly acting with long-term effects, non-irritating to the pulp, painless and easy to apply without staining the tooth surface.[18]

Initial Steps for Treating Dentin Hypersensitivity

Because of the difficulty measuring the pain response, treating dentin hypersensitivity can be challenging for the dental professional. The dentist should initially follow these steps:

1. Complete a comprehensive diagnosis using all the previously mentioned tools.
2. Rule out possible underlying diseases or structural problems.
3. If diagnosis confirms dentinal hypersensitivity due to personal habits, the dentist should:
   - Educate the patient about dietary acids and good oral care habits.
   - Recommend different teeth brushing methods, if appropriate.
   - If the patient is suffering from bruxism, keep teeth grinding in check with an occlusal splint and bring awareness to jaw clenching during the day.[19]
   - Recommend a desensitizing agent for home use.
   - Apply topical desensitizing agents.
4. If diagnosis confirms dentinal hypersensitivity after dental treatment, it should be addressed according to the actual dental procedure:
   - Sensitivity after dental restorations - Inform the patient that it should subside within 1 to 2 weeks.[6]
   - Sensitivity following periodontal treatment (scaling and root planing) - When calculus is removed from a tooth, the root surface may be exposed - temporary sensitivity may be avoided by the application of a desensitizing agent following the treatment (fluoride varnish is a good option).[15,17]
   - Sensitivity following crown cementation - Patients usually report sensitivity to cold - occlusion should be checked for premature contacts and occlusion adjustment completed as necessary - the patient should be informed that sensitivity is temporary.

Treatment options range from minimally invasive procedures, such as application of a dentin-bonding agent, to more aggressive therapy if dentin hypersensitivity is not resolved.

Desensitizing Products

Dahnhardt, *et al.*[20] noted that the two main treatment options for dentin hypersensitivity are desensitization of the nerve and the mechanical occlusion or covering of the dentin tubules. The therapeutic gold-standard treatment that can completely eliminate dentin hypersensitivity has not been discovered and every desensitizing agent currently used has a shortcoming.[21] The classification of dsensitizing agents classification is based on mode of administration (at home treatment or in-office treatment) plus mechanism of action.

At Home Treatments

Historically, over-the-counter products are the first line of treatment for most patients with dentin sensitivity. The most widely used products are anti-sensitivity dentifrices. They are considered the primary at-home non-invasive treatments because they are simple to use and are cost-effective. Potassium nitrate and stannous fluoride are the most common ingredients in the anti-sensitivity dentifrices. Potassium nitrate interferes with the transmission of the nerve impulse, and stannous fluoride effectively blocks dentinal tubules by forming a smear layer at the surface.

1. Potassium Nitrate Dentifrice

Potassium salts (potassium nitrate, potassium chloride or potassium citrate) are known as "nerve-numbing" agents. The literature shows four-week exposure time is needed for 5% potassium nitrate to exert a noticeable desensitizing effect. Dental products that contain potassium nitrate raise the extracellular potassium ion concentration and affect polarization.[22,23] When the concentration is sustained over time, the synapse between nerve cells is blocked, the nerve excitation is reduced and the tooth is less sensitive to the stimuli.[24] While some clinical studies showed that dentifrice containing potassium nitrate effectively reduces dentin hypersensitivity,[22,23] other systematic reviews

failed to find sufficient evidence to support the efficacy of potassium nitrate toothpaste.[18,24,25] A contemporary (2017) meta-analysis found sufficient evidence to support its desensitizing effect.[26] Some market products that contain potassium nitrate are listed in **Table 1**.

2. Stannous Fluoride

Stannous fluoride is the only fluoride compound that provides protection against many oral health conditions. Research has demonstrated anti-plaque, anti-gingivitis, anti-sensitivity, and anti-caries efficacy. It has also been shown to suppress breath malodor.[27-30] Baig, *et. al*[27] showed in an *in-situ* study (2005), that stannous fluoride created a smear layer that blocked dentinal tubules, resulting in a marked reduction of sensitivity. The outcome was attributed to the fact that blocking the tubules leads to limited fluid flow and prevention of the stimulation of the mechanoreceptors.

Stannous fluoride has been delivered via various vehicles (mouth rinse, dentifrice, gel). The American Dental Association granted its *Seal of Acceptance* to non-aqueous stannous fluoride gel formulations (Colgate® Gel-Kam, 0.4% stable stannous fluoride, and Crest® Pro-Health toothpaste) for therapeutic prevention of sensitivity and caries.[7]

In the past, the temporary extrinsic tooth staining associated with the long-term use of stabilized stannous fluoride products was the primary limitation to its usage. Due to advances in dentifrice technology, incorpoating sodium hexametaphosphate has mitigated this undesirable staining effect.[31]

Several researchers have reported a gradual decrease in sensitivity following application of stannous fluoride starting at two weeks after initiation of treatment and continuing throughout a 16-week period.[32,33] It was also reported that an application of 0.4% stannous fluoride gel resulted in significantly less sensitivity in patients during a four to eight-week period in a two-phase experimental study. It was also found in two different randomized controlled clinical trials that brushing twice daily with stabilized stannous fluoride dentifrice provides superior reduction of dentinal hypersensitivity versus a marketed sodium fluoride dentifrice, and a dentifrice containing 8.0% arginine, calcium carbonate and sodium monofluorophosphate.[31,34,35]

Table 1 - Dentin Hypersensitivity Products

Delivery	Categories of Agents/Available Products
SELF-CARE *OTC Products*	**Potassium nitrate** • *Sensodyne Pronamel Daily Protection* • *Arm & Hammer Sensitive Enamel* • *Colgate® Sensitive Prevent & Repair* • *Tom's of Maine™ Rapid Relief-Sensitive* **Stannous Fluoride** • *Colgate® Gel-Kam* • *Crest® Pro-Health toothpaste* **Bioactive Glass Calcium Sodium Phosphosilicate (NovaMin)** • *Sensodyne® Repair and Protect toothpaste* **Arginine** • *Colgate Sensitive Pro-Relief™ toothpaste* **Oxalate** • *Listerine® Advance Defense Sensitive mouthwash* **Potassium Nitrate** • *PreviDent® 5000 Sensitive* **Hydroxyapatite** • *Cavex Bite&White ExSense*
Professionally Prescribed Dentifrices	**Calcium Sodium Phosphosilicate (NovaMin)** • *NUPRO NUSolutions paste®*
PROFESSIONAL CARE	**Fluoride Varnish** **Prophylaxis Pastes** • *Topex® prophy paste* • *Oxalate solution* • *Super Seal (Bisco)* • *Colgate® Sensitive Pro-Relief™ Desensitizing Paste* **Resin, adhesives** • *Gluma Desensitizer PowerGel* • *Clearfil®Se Protect* • *Calm-It™ Desensitizer* **Lasers** • *GaLAS, Nd:YAG, ErYAG, CO_2*

3. Calcium Sodium Phosphosilicate

Calcium Sodium Phosphosilicate is an active ingredient used in professional and over-the-counter dental products. It comprised of calcium, sodium, phosphorous, and silica. It was originally developed as bone regenerative material. Calcium Sodium Phosphosilicate is a bioactive glass that, when exposed to body fluids, reacts and directly forms hydroxycarbonate apatite, similar to enamel and dentin tooth mineral.[35,36]

Several recent studies demonstrated the desensitizing effect of calcium sodium phosphosilicate, attributing the effect to the formation of mineralized layer that occludes exposed dentin surfaces.[35,37-40] Over the past decade, NovaMin, the branded form of Calcium Sodium Phosphosilicate, is found in multiple professional and over-the- counter dental products designed to relieve tooth sensitivity. It is now sold in over 20 countries.[41]

The concentration of NovaMin in homecare products (Sensodyne® Repair and Protect toothpaste) ranges from 2.5% to 7.5%. Its concentration is usually higher in professional-use products.[42] The professionally applied prophylaxis paste is used as an in-office treatment, typically to treat dentin hypersensitivity localized to one or more teeth.[17]

One study (2010) reported increased efficacy of calcium sodium phosphosilicate, but showed a higher incidence of gingival inflammation with increasing concentrations as an adverse effect.[35] This study had only twenty-two participants in each treatment group. With such small number of participants, conclusions must be viewed with caution.

A recent meta-analysis (2017), found sufficient evidence to support the use of a potassium-stannous fluoride-calcium sodium phosphosilicate-and arginine-containing desensitizing toothpaste for treatment of dentin hypersensitivity.[43]

4. Arginine

Arginine is an amino acid naturally present in saliva that works in conjunction with calcium carbonate and phosphate to occlude dentinal tubules.[44] A toothpaste containing 8% arginine (Pro-Argin), calcium carbonate, and 1450-ppm fluoride (sodium monofluorophosphate) (Colgate Sensitive Pro-Relief™) has been documented to effectively deliver instant and lasting relief for dentin hypersensitivity for a period of four weeks.[45-50]

Another product was introduced in 2017 as an over-the-counter pro-arginine and calcium-containing desensitizing product (Colgate® Sensitive Toothbrush + Built-in Sensitivity Relief Pen). It is a toothbrush specifically designed with extra soft bristles and soft rubber polishing cups for sensitive teeth and gums.

5. Potassium Oxalate

A potassium oxalate-containing oral rinse, was recently approved for use in the United States. A clinical study by Sharma and McGuire reported dentin hypersensitivity desensitizing within a five-day period after multiple applications of the rinse.[51]

6. Bioactive Glass

An available bioactive glass is NovaMin. It is a synthetic mineral composed of calcium, sodium, phosphorus and silica technically described as sodium calcium phosphosilicate. Structurally it is similar to tooth mineral composition. The bioglass reacts with the saliva in the mouth to form a protective layer of hydroxyapatite on the tooth, occluding dentin tubules, preventing tooth sensitivity. It typically takes approximately four weeks for the patient to experience relief. On-going use is required to maintain the benefit. Hydroxyapatite (HAP) has been shown to block dentinal tubules (*in vitro*) and to be a safe and effective additive in oral care products that reduce dentin hypersensitivity clinically (*in vivo*).[52,53]

In-Office Products/Treatments

Over-the-counter products for use at home may not be able to manage some of the dentin sensitivity cases. Professional in-office treatments are available for such cases.

1. Fluoride Varnishes

The most popular in-office treatment for dentin hypersensitivity is fluoride varnish, a resin-based fluoride. 2.26% fluoride varnish with 22,600 ppm Fluoride (5% Sodium Fluoride) should be the product of choice. Fluoride varnish is easy to apply, low-cost and generally safe to use in the mouth. It should not be used if the patient has an allergy to one of the ingredients in the varnish. The resin varnish forms a sticky covering over the tooth and becomes hard upon contact with saliva. The agent's mode of action involves calcium fluoride (CaF_2) deposition on the tooth surface with the formation of fluorapatite that blocks the opened tubules. Several commercial fluoride varnishes have been investigated in clinical trials, with a 20 to 50% reduction in dentin hypersensitivity reported.[45,47,49,54]

Fluoride varnish is effective when applied to teeth dried with cotton gauze. Rubber cup polishing or professional cleaning is not required. The frequency of fluoride varnish applications depends on the professional's judgment, related to when the patient reports the status of the teeth sensitivity.

2. Prophylaxis Pastes

Prophylaxis pastes, used in the dental office, are another professional treatment option available for relief of dentin hypersensitivity. Many compounds are available and have been shown to occlude open dentinal tubules. Colgate® Sensitive Pro-Relief™ Desensitizing Paste (an in-office product with Pro-Argin technology) is available in the United States in the form of a tube or premeasured single-use containers. Patients report they have virtually instant relief from both tactile and temperature sensitivity following its use. Schiff, *et al.,* reported statistically significant reduction in dentin hypersensitivity immediately after a single professional application, which was sustained over a period of twenty eight days.[50]

3. Prescription Dentifrices

PreviDent® 5000 Sensitive (1.1% Sodium Fluoride, 5% Potassium Nitrate) is a prescription strength (5000 ppm fluoride) toothpaste formulated for sensitive teeth. It has a unique liquid gel formula that enables faster fluoride dispersion than paste-form toothpaste. It is recommended for use twice daily in place of regular toothpaste.[56-59]

Cavex Bite & White ExSense (Cavex Holland BV) is another prescription dentifrice that has shown fast and long-lasting relief from dentin hypersensitivity. It has a blend of hydroxyapatite and hydro-dispersing clay that has unique properties to ensure accelerated dispersion, helping boost hydroxyapatite penetration. It was reported that the hydroxyapatite penetrates deep into the tubules and micro-cracks in the enamel completely sealing off the areas causing sensitivity.[60-61]

Products combining 5,000 ppm sodium fluoride and NovaMin technology have been introduced to the market in the past few years. These products purport that they provide significant dual benefits for patients targeting caries and dentin hypersensitivity.

4. Bonding Agents

Light-cured bonding agents are used in the dental offices to immediately block open dentinal tubules and reduce dentin hypersensitivity. CLEARFIL® SE Protect (Kuraray Dental, Okayama, Japan) is a self-etching long-term fluoride release light cure monomer that has an antimicrobial benefit. The ability to create a cross-linked protein leads to plugging of the dentinal tubules. Dentists have reported satisfactory clinical results.[62]

Gluma® Desensitizer and Gluma® Desinstizer PowerGel (Heraeus Kulzer, Hanau, Germany) have been on the market for over 10 years and used worldwide to reduce dentin hypersensitivity. They have been reported to have the ability to penetrate up to 200µm into the exposed dentinal tubules where they form multiple layers of protein septa preventing intratubular fluid movement following osmotic changes.[62,63] Calm-It™ Desensitizer (DENTSPLY Caulk) has a similar concept.

5. Lasers

Various laser (light amplification by stimulated emission of radiation) types have been tested and used for dentin hypersensitivity treatment, including; Nd:YAG; Er:YAG; CO_2; He-Ne; and GaAlAs diode lasers. The effectiveness ranges reported vary widely, as do the laser type and parameters used. Lasers were used with various energy settings and with wavelengths ranging from 632.8 nm (He-Ne) to 10,600 nm (Er:YAG, CO_2).[10,21] The mechanism of action of lasers in treating hypersensitivity is not clear, but it has been proposed that lasers coagulate the proteins inside the tubules and block the movement of fluid. For low output-power lasers (diode laser=780-900 nm or He-Ne lasers=632.8 nm) the desensitizing effect seems to be related to laser activity at the nerve level mediating an analgesic effect related to depressed nerve transmission.[64] The desensitizing effect of the middle output-power lasers (Nd:YAG, CO_2, and Er:YAG) could be related to an interaction with the dental pulp, causing a photobiomodulating (PBM) effect, increasing the cellular metabolic activity of the odontoblasts and occluding the dentinal tubules with tertiary dentin production. PBM is the application of light delivered by a low power laser of light-emitting diode to promote tissue repair, reduce inflammation or induce analgesia.[6,21,64] A systematic review comparing laser therapy with desensitizing agents suggests that lasers may have a slight clinical advantage over topically applied medicaments, especially in severe cases.[21] A recent study explored the possible synergistic effect of lasers and topically applied treatments.[65]

Long-Term Management of Dentin Hypersensitivity

Treatment of dentin hypersensitivity, at-home or in-office, is only one aspect of the management of dentin hypersensitivity. It is imperative in achieving lasting comfort to consider effective plaque control, strategies to enhance salivary flow, increase salivary pH and improve its buffering capacity and implement dietary modifications as appropriate. Controlling dentin hypersensitivity is an ongoing challenge that requires dentist intervention AND patient cooperation.

Conclusion

The management of dentin hypersensitivity can be carried out at home with over-the-counter agents containing potassium salts or other effective compounds and in-office using a variety of treatments including topically applied desensitizing agents (fluoride, potassium nitrate, oxalate, calcium phosphates), adhesives and lasers. Prevention and at-home treatments are a good place to start. They can later be supplemented with in-office treatments if needed. However, with the conflicting findings about both self-applied and professional methods, evidence-based analysis cannot currently proclaim one agent or technique to be superior in the management of dentin hypersensitivity. Clinicians should initiate therapy for dentin hypersensitivity with conservative approaches, progressing to more aggressive, time-consuming or costly procedures if they are unsuccessful.

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POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **Dentin hypersensitivity is a:**
   a. short sharp pain with slow onset, which may be either localized or generalized.
   b. short sharp pain with fast onset, which may be either localized or generalized.
   c. chronic long-lasting pain, which may be either localized or generalized.
   d. short sharp pain with fast onset, which is only localized.

2. **The etiology of dentinal hypersensitivity had been explained by several theories. The widely accepted is the:**
   a. modulation theory.
   b. transducer theory.
   c. "gate control" theory.
   d. vibration theory.
   e. hydrodynamic theory.

3. **Dentin hypersensitivity may be caused by ALL EXCEPT:**
   a. loss of enamel and/or gingival recession exposing the root surface.
   b. exposure of dentinal tubules which will lead to sensitivity.
   c. exposed dentin stimulated with different stimuli as air pressure/cold air, cold food or drink, hot food and drink, high levels of acidity in drinks or food.
   d. leaking broken restoration.

4. **What pain scale is reported to be associated with increased compliance compared with the other scales and is especially recommended for older patients?**
   a. (VAS) Visual Analogue System
   b. (NRS) Numeric Scale System
   c. (VRS) Verbal Rating Scale)
   d. A and C

5. **Grossman in 1935, mentioned that the ideal desensitizing agent should NOT be:**
   a. slow acting with long-term effects.
   b. non-irritating to the pulp and painless.
   c. easy to apply without staining the tooth surface.
   d. All of the above

6. **Potassium nitrate is a typical approach to:**
   a. mechanically block the exposed dentinal tubules.
   b. rebuild the lost enamel.
   c. stimulate the neuronal transmission of the stimuli.
   d. block nerve sensation.
   e. None of the above

7. **Stannous fluoride is a compound that provides protection against which oral health conditions:**
   a. anti-plaque (anti-caries)
   b. anti-gingivitis; and anti-sensitivity
   c. anti-plaque (anti-caries); anti-gingivitis; and anti-sensitivity
   d. None of the above

8. **_____ is bioactive glass that, when exposed to body fluids, reacts and directly forms hydroxycarbonate apatite, similar to enamel and dentin.**
   a. Potassium nitrate
   b. Calcium Sodium Phosphosilicate
   c. Oxalate
   d. Stannous Fluoride
   e. Arginine

9. **The following are examples of in-office treatments for dentin sensitivity, EXCEPT:**
   a. fluoride varnish
   b. lasers
   c. oxalate strips
   d. prophylaxis pastes with desensitizing agent

10. **Photobiomodulating (PBM) has the following effects EXCEPT:**
    a. decreases the cellular metabolic activity of the odontoblasts.
    b. promotes tissue repair
    c. reduces inflammation
    d. induces analgesia by occluding the dentinal tubules with tertiary dentin production

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