

Dental Hypersensitivity: A Review



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Conflict of Interest Disclosure Statement

- Ms. Walters is a retired employee of P&G and does consulting work for P&G. She has no relevant financial relationships to disclose.

Introduction

Dental hypersensitivity is a common clinical condition that is frequently encountered yet it is often under-reported by patients, or misdiagnosed by clinicians. This course will address the etiology, prevalence and diagnosis of dental hypersensitivity as well as review clinical evidence behind common treatments.

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Overview

This review will address the etiology of the condition commonly referred to as “dental hypersensitivity,” “dentine sensitivity,” “root sensitivity” or “tooth sensitivity.” More specifically, this course will review the prevalence and diagnosis of the condition as well as reviewing clinical evidence behind various popular home care products and in-office treatment options.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Discuss the prevalence of dental hypersensitivity and common contributing factors.
- Explain the hydrodynamic theory, widely accepted as the cause for dental sensitivity.
- Discuss common diagnostic tools.
- List common ingredients used in at-home and in-office desensitizing products.
- Discuss the mode of action of common ingredients.
- Discuss the clinical evidence behind common treatment approaches including in-office treatments.

Prevalence

Dental hypersensitivity (DH) is a global oral health issue and a significant challenge

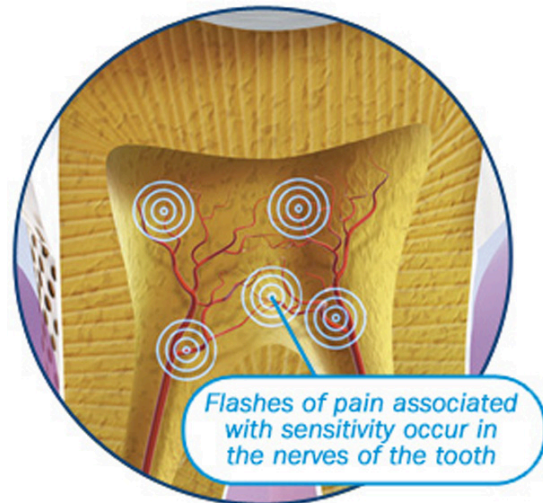


Figure 1. Pictorial display of origin of pain associated with sensitive teeth.

for most dental professionals. Symptoms of dental hypersensitivity are generally reported by the patient and are difficult to describe and challenging to accurately diagnose because other dental diseases have to be ruled out first, such as dental caries, cracked-tooth syndrome, and defective restorations, among others. The condition has been defined by an international workshop on DH as follows: “DH is characterized by short, sharp pain arising from exposed dentine in response to stimuli, typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other dental defect or pathology”.^{1,2} (Figure 1).

Dental hypersensitivity incidence ranges from 4-74%.¹ The variations in the reports may be because of difference in populations and different methods of investigations. The methods employed are usually patient questionnaires or clinical examinations. A slightly higher incidence of DH is reported in females than in males. While DH can affect the patient of any age, most affected patients are in the age group of 20–50 years, with a peak between 30 and 40 years of age.³⁻⁹ The most common teeth affected by DH are the canines and premolars and the buccal aspect of cervical area is the commonly affected site.⁴ Among periodontal patients, the frequency is much higher (60-90%).⁵⁻⁷

Pathogenesis:

Dentin is covered by enamel on the crown surface and by a thin layer of cementum on the root

surface of the tooth and is sensitive to stimuli. DH develops in two phases: lesion localization and lesion initiation. Lesion localization occurs by loss of protective covering, enamel and cementum over the dentin, thereby exposing the dentinal tubules. Exposure is attributed to attrition, abrasion, erosion and abfraction. However, dentinal exposure mostly occurs due to gingival recession which can be due to toothbrush abrasion, pocket reduction surgery, tooth preparation for crown, excessive flossing or secondary to periodontal diseases.¹⁸ In the second phase, the exposed dentin will only be sensitized if the tubular plugs and the smear layer are removed exposing them to the external environment. Both mechanical and chemical factors are effective in removing the smear layer from the dentinal tubules. A couple culprits involved in removing the smear layer are acidic foods and acidic drinks.

Theories

A variety of theories have been suggested to help explain the mechanism involved in the etiology of dentinal hypersensitivity.¹¹ The transducer theory, the modulation theory, the "gate" control and vibration theory, and the hydrodynamic theory have all been presented and discussed throughout the years. The latter, "hydrodynamic theory," developed in the 1960's and based upon two decades of research, is now widely accepted as the cause of tooth sensitivity.¹² Before explaining the "hydrodynamic theory" it is important to point out that none of these mechanisms fully explain dentin hypersensitivity, indicating unexplained mechanisms are possibly responsible. The widely accepted hydrodynamic theory asserts that when the fluid within the dentinal tubules, absent of a smear layer, or enamel or cementum, is subjected to thermal, chemical, tactile or evaporative stimuli, the movement of the fluid stimulates the mechanical receptors which are sensitive to fluid pressure, resulting in the transmission of the stimuli to the pulpal nerves (Figure 2) ultimately causing the pain response.¹¹

Berman¹¹ describes this reaction as:

"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 'mechanoreceptor'."

Based on the hydrodynamic theory, dentinal hypersensitivity is a transient tooth pain. In order to exhibit a response to the stimuli, the tubules would have to be open at the dentin surface as well as the pulpal surface of the tooth. Anatomically, the tubules in the area closest to the pulp chamber are wider, and the number of tubules per unit area increases almost two-fold from the outer surface to the pulp.¹³

The most important variable affecting the fluid flow in dentin is the radius of the dentinal tubules. If the radius is reduced by one-half, the fluid flow within the tubules falls to one-sixteenth of its original rate. Consequently, the creation of a smear layer or the occlusion of the tubules will significantly reduce sensitivity.^{14,15}

Diagnosis

The reason(s) for tubules to be exposed or open should be assessed during a visual examination of the teeth. Additionally, a detailed dietary history should be taken. Useful diagnostic tools are the air/water syringe (thermal), dental explorer (touch), percussion testing, bite stress tests, and other thermal tests such

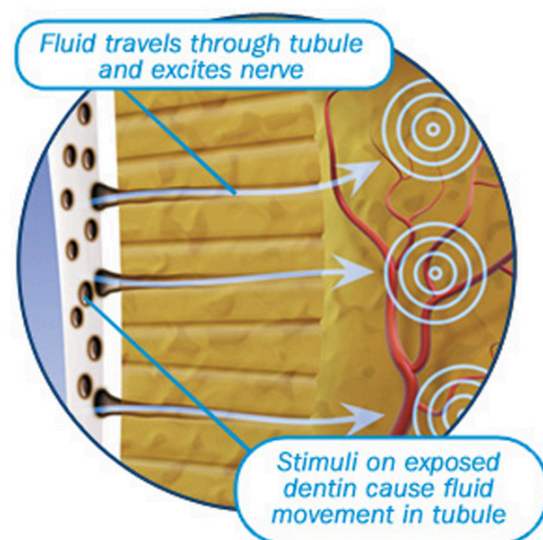


Figure 2. Depiction of Brannstrom's Hydrodynamic Theory.

as an ice cube, and assessment of occlusion. Since dentinal hypersensitivity is essentially diagnosed by exclusion, a comprehensive dental examination will ultimately rule out other underlying conditions for which sensitivity may be a symptom such as cracked tooth, fractured restoration, chipped teeth, dental caries, gingival inflammation, post-restorative sensitivity, marginal leakage and pulpitis. Excessive intake of dietary acids such as citrus juices and fruits, carbonated drinks, wines and ciders have been identified as potential risk factors for dental hypersensitivity.^{4,12,14} The dietary history provided by the patient will assist in identifying the risk factors the patient may have for tooth sensitivity. Erosion is one of the most common causes of irreversible enamel loss.¹⁵

In addition, other risk factors should be ferreted out during an examination such as toothbrush abrasion (Figure 3), chemical erosion (Figure 4), thin enamel, gingival recession, exposed dentin, and eating disorders such as bulimia. The patient will be able to assist in diagnosis by identifying the pain-inciting stimuli, i.e., thermal, tactile, etc., as well as describing the pain. The response to stimuli varies from patient to patient. Factors such as individual pain tolerance, emotional state, and environment can contribute to the variety of responses between and among patients.¹⁶

The most commonly cited reason for exposed dentinal tubules is gingival recession (predisposing factor).¹⁷ Gingival recession is the reduction of the height of the gingival margin to a location apical to the CEJ. Chronic exposure to bacterial plaque, toothbrush abrasion, abfraction, gingival laceration from oral habits such as toothpick use, excessive flossing, crown preparation, inadequate

attached gingiva, inadequate labial plate of the alveolar bone and gingival loss secondary to disease or surgery are some but not all causes of gingival recession.¹⁷ Recessed areas may become sensitive due to the loss of cementum, ultimately exposing dentin. Probing depths, recessed areas (areas of gingival recession), and sensitivity reported by the patient must be accurately recorded and monitored to provide a reference for the patient's disease activity over time. By removing the etiology of DH (for example, over enthusiastic brushers, periodontal treatment patients, bulimics, people with xerostomia, high acid food/drink consumers, chewing smokeless or snuff tobacco) it can be prevented from occurring or reoccurring.

Treatments

Classifications of Desensitizing Agents based on:

I. Mode of administration

- At home treatment
- In-office treatment

II. Mechanism of action

- Nerve desensitization
 - Potassium nitrate
- Protein precipitation
 - Gluteraldehyde
 - Silver nitrate
 - Zinc chloride
 - Strontium chloride hexahydrate
- Plugging dentinal tubules
 - Sodium fluoride
 - Stannous fluoride
 - Strontium chloride
 - Potassium oxalate
 - Calcium phosphate
 - Calcium carbonate
 - Bio active glasses ($\text{SiO}_2\text{-P}_2\text{O}_5\text{-CaO-Na}_2\text{O}$)



Figure 3. Tooth Abrasion.



Figure 4. Tooth Erosion.

Images courtesy, Dr. Beatrice Gandara, University of Washington, School of Dentistry

Dentine adhesive sealers

- Fluoride varnishes
- Oxalic acid and resin
- Glass ionomer cements
- Composites
- Dentin bonding agents

Lasers

- Neodymium:yttrium aluminum garnet (Nd-YAG) laser
- GaAlAs (gallium-aluminium-arsenide laser)
- Erbium-YAG laser

Homeopathic medication

- Propolis

Treating dentinal hypersensitivity can be challenging for the dental professional because of the difficulty related to measuring the pain response as the response can often vary from patient to patient. In addition, if the dentin exposure is due to personal habits, it may be difficult for patients to change their behavior.

In 1935, Grossman addressed the requirements for an ideal desensitizing agent as: rapidly acting with long-term effects, non-irritating to the pulp, painless and easy to apply without staining the tooth surface. These requirements still exist today when considering an ideal solution to dentinal hypersensitivity.¹⁸ There are two common approaches to treating dentinal hypersensitivity, nerve depolarization and tubule occlusion. Furthermore, treatment options can be classified as either invasive or non-invasive in nature. Examples of invasive procedures administered in-office include gingival surgery, application of resin adhesive materials such as dentin bonding agents, or a pulpectomy. Dentifrices and other products for home use are non-invasive. Finally, treatments can be categorized based on whether they can be applied by the patient (over-the-counter) or require professional application. For the purposes of this CE course, the focus is on those treatments that disturb the neural response to pain stimulus and those that block/occlude the dentinal tubules.

Over-the-Counter Products

Over-the-counter products for the treatment of tooth sensitivity are considered to be a simple and cost-effective first line of treatment for most

patients.¹⁸ The primary at-home non-invasive treatment option has historically been anti-sensitivity dentifrices. The two most common ingredients are potassium nitrate, which interferes with the transmission of the nerve impulse, and stannous fluoride and arginine, which blocks dentinal tubules by forming a smear layer at the surface.

Potassium Nitrate Dentifrice

Potassium salts move along the dentinal tubules and through blocking the action of the intradental nerve fibers decrease the excitability of the tooth. Potassium salts such as potassium chloride, potassium citrate and potassium nitrate are known to interfere with the nerve impulse and is commonly found in desensitizing toothpaste.¹⁹ Potassium nitrate products raise the extracellular potassium ion concentrations and affect polarization. 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. A large number of studies, published since the early seventies, have investigated the use of potassium nitrate (KNO_3) as an effective active ingredient in treating dentinal hypersensitivity.²⁰⁻³⁴

The use of toothpastes which contain potassium nitrate and fluoride has a positive effect on reducing DH. A four-week exposure time is widely used in these clinical trials because results have shown that this time is needed for 5% KNO_3 to exert its desensitizing effect.²³ The use of a broadly accepted positive or negative control toothpaste formulation or product



Figure 5. Illustration of the Yeaple Probe.

has been increasingly used over the years in comparative trials because the condition itself can appear to be self-resolving within the time scale of the study. Over time, investigators have chosen various methods to capture subjective responses; controlled reproducible stimuli and objective measurements are preferred.

In 2006, the Cochrane Collaboration published a systematic review²⁶ of potassium nitrate toothpastes for the treatment of dentinal hypersensitivity based on clinical trials conducted up to the year 2005 involving KNO₃ toothpaste compared to non-KNO₃ toothpaste. This review focused on studies that incorporated similar methods in order to determine if KNO₃ is an effective agent in reducing dentinal hypersensitivity. The results were obtained by measuring tactile (Figure 5), thermal, and air blast stimuli as well as patients' subjective assessment of pain during everyday life. The exposure periods ranged from six to eight weeks, reporting outcome measurements as a mean change from baseline.

The meta-analysis included six studies,²⁷⁻³² and all showed a significant effect on sensitivity assessed by air blast and tactile methods at the 6 to 8 week follow-up. However, there was no significant effect observed at the 6 to 8 week follow-up for the subjective assessment. The authors concluded the support for the efficacy of potassium nitrate toothpaste for dentinal hypersensitivity was based on a very small sample size, thus evidence of the effectiveness of KNO₃ is not clear, suggesting more clinical trials need to be conducted and published. There is no current research published to support a different conclusion than what is stated above even though new product lines are being marketed using this technology.

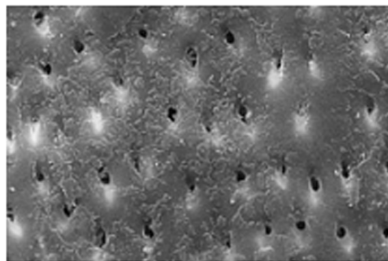


Figure 6a. Open tubules following treatment with non-sensitivity fluoride toothpaste.

Products currently on the market that contain potassium nitrate include Sensodyne Repair & Protect, Sensodyne Fast Sensitive Teeth Relief, Crest® Sensitivity Whitening plus Scope, Crest Sensi-Relief Plus Scope Toothpaste, Colgate® Sensitive Prevent & Repair, Colgate Enamel Health Sensitivity Relief, Arm & Hammer® Advanced Whitening Sensitive, Tom's of Maine™ Rapid Relief-Sensitive and Hello Sensitive Relief Fluoride Toothpastes.

Stannous Fluoride

Stannous fluoride has been incorporated into oral hygiene products to prevent dental caries,³⁵ reduction of plaque formation,³⁶ control of gingivitis³⁷ suppression of breath malodor,³⁸ and reduce dentinal hypersensitivity since the 1960s. The ADA has recognized the desensitizing properties of stannous fluoride by granting the ADA Seal of Acceptance to a non-aqueous stannous fluoride gel formulation (Gel-Kam) for the therapeutic prevention of sensitivity and caries as well as to Crest® PRO-HEALTH® toothpaste.²¹ The effect of stannous fluoride is the result of the reaction between the stannous ion and the dental hard tissue which leads to a protective layer on the tooth surface that is resistant to an acid challenges.⁴⁰

In situ research shows root dentin treated with stannous fluoride exhibits tubule occlusion at the surface by the formation of a smear layer (Figure 6).³⁹ When the tubules are blocked, fluid flow is limited and the stimulation of the mechanoreceptors does not occur, thus preventing the pain response.

Stannous fluoride has been delivered via a mouth rinse, dentifrice, and gel for some time. Research by Thrash et al.^{43,44} in the 1990's suggested there is a gradual decrease in

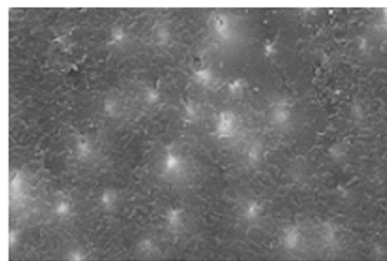


Figure 6b. Closed tubules following treatment with SnF₂ dentifrice.

sensitivity starting at two weeks and continuing throughout the 16-week period from initiation of treatment. Thrash and colleagues conducted a two-phase experimental design study comparing a 0.4% stannous fluoride gel to an aqueous 0.717% fluoride solution and a placebo to evaluate the effect of the products on hypersensitivity tooth pain and to determine the precise time of onset of any effect on dentinal hypersensitivity. Sensitivity to thermal stimuli was assessed prior to the first application and then at 2, 4, 8, and 16 week intervals after the initial application. The results indicated subjects who applied the 0.4% stannous fluoride gel reported significantly less sensitivity during the four to eight week period. The stannous fluoride gel resulted in the lowest mean threshold temperature compared to the other products.

Historically, one limitation to the use of stabilized stannous fluoride has been the potential for temporary extrinsic tooth staining associated with the long-term use of these products. Due to advances in dentifrice technology, this occurrence has been mitigated by incorporating sodium hexametaphosphate, an advanced tartar control and whitening ingredient, in the formulation marketed as Crest® PRO-HEALTH® toothpaste. Also, a variety of stabilization chemistries have been employed in modern stannous formulations to mitigate stains.

A recent meta-analysis by West, et al, looked at randomized clinical trial conducted over the past three decades to assess their effects on DH and enamel erosion. Fourteen (14) randomized and controlled clinical trials (RCTs) were identified assessing DH relief specifically. The 14 studies were conducted involving 1287 participants across the US, Canada and China. Benefits for stannous fluoride over both negative and positive controls ranged from 22 to 142% for alleviation of DH. Six RCTs assesses SnF₂ versus a positive control (potassium nitrate, arginine) found a 22% benefit for SnF₂ using the Schiff assessment method. Final results in the meta-analysis supports better desensitizing efficacy of bioavailable gluconate chelated SnF₂ toothpaste. The scope of the research is robust involving 20 studies in different regions of the world and

are consistent with the literature and provides support for the use of stannous fluoride for those experiencing dentinal hypersensitivity.⁴⁵

In addition, there have been several studies demonstrating similar results during a 3 day study period in one study, as well as a 2 week study period in four studies.⁴⁶⁻⁴⁹ In two randomized, double-blind clinical trials, this stabilized stannous fluoride toothpaste significantly reduced thermal and tactile sensitivity versus a negative control.^{49,50} More recently, He et al, demonstrated in two different randomized controlled clinical trials that twice daily brushing with the stabilized stannous fluoride dentifrice provides superior dentinal hypersensitivity improvement versus a marketed sodium fluoride dentifrice, and a dentifrice containing 8.0% arginine, calcium carbonate and sodium monofluorophosphate.^{51,52} The stannous fluoride dentifrice provided some relief after the first brushing relative to each control, with the benefit growing larger over the study period with twice daily use. When compared to sodium fluoride/triclosan dentifrice, there was a similar outcome, superior dentinal hypersensitivity improvement with significant greater relief after two weeks and a larger benefit at eight weeks with twice daily brushing.⁵³ In separate clinical research, this unique dentifrice provided significant extrinsic whitening relative to a positive control.^{53,54} In addition, a systematic review was recently published by Konradsson et al included scientific evidence for the efficacy of stabilized stannous fluoride dentifrice in relations to DH when compared with standard fluoride dentifrices. Eleven (11) DH articles were published between 2005 and 2016 and represented 1361 patients with 618 in the test group and 617 in the control group. Toothpaste containing stabilized stannous fluoride with and without sodium hexametaphosphate was shown to have preventive and therapeutic effects on dentin hypersensitivity especially when used twice daily for 1 minute. The stannous fluoride product was shown to be efficacious after 3 days and lasting up to 8 weeks.⁴⁶ Crest Pro-Health products and Colgate Stannous Fluoride Daily Repair are examples of toothpastes with stannous fluoride ingredient.

Arginine

Arginine is an amino acid which occurs naturally in saliva. The mechanism of action for toothpastes containing arginine bicarbonate and calcium carbonate is plugging of open dentinal tubules. The plug is able to remain even after exposure to acids. In 2013 Sharif et al conducted a systematic review of Arginine toothpastes effectiveness in treating DH. The review highlighted that the studies conducted thus far involved small numbers of subjects and reduced DH in the short-term. The authors recommended that further well designed RCTs should be conducted looking at medium and long term effects of Arginine on DH.⁴⁷ There is a cross-over product (at home use and professionally applied) Colgate Anywhere Anytime Sensitivity Relief System that has the following ingredients: Arginine bicarbonate, benzyl alcohol, calcium carbonate, cellulose gum, flavor, glycerin, propylene glycol, sodium bicarbonate, sodium saccharin, sodium silicate, titanium dioxide and water. Very little research has been conducted to come to any conclusion regarding the effectiveness of Arginine products. In regards to clinical significance, the results of this clinical study, together with the results of published pivotal studies, demonstrate that a desensitizing toothpaste containing 8% arginine and calcium carbonate, with or without fluoride, provides statistically significant reduction in dentin hypersensitivity when applied by a dental professional prior to a professional dental prophylaxis. The results also demonstrate that this desensitizing toothpaste provides statistically significant reductions in dentin hypersensitivity when used subsequently as an adjunct to routine twice daily tooth brushing.⁴⁷

Bioactive Glass

Dentifrices containing desensitizing agents have been the most popular first-line treatment for sensitive teeth, but there are some drawbacks. It typically takes time (approximately 4 weeks) to experience relief and on-going use is required to maintain the benefit.

One such product is NovaMin, a synthetic mineral composed of calcium, sodium, phosphorus and silica releases deposits of crystalline, hydroxyl-carbonate apatite which is structurally similar to tooth mineral

composition. NovaMin is technically described as sodium calcium phosphosilicate.

Method of Action

The formation of bioglass reacts with the saliva in the mouth to form a protective layer of hydroxyapatite on the tooth, thereby, occluding dentin tubules. This layer prevents the discomfort that is tooth sensitivity.

A number of clinical studies (5) investigating the efficacy of NovaMin for four and six weeks have been conducted. A product name you may be familiar with is Sensodyne Repair and Protect. An overview of the clinical evidence for the use of NovaMin to treat dentinal hypersensitivity was addressed by Gendreau et al. Clinical evidence supports the effectiveness of the 5% and 7.5% product twice daily brushing for pain relief from this malady.⁵⁶ Burwell et al conducted four experiments to demonstrate the ability of NovaMin to rapidly occlude tubules, remain on the dentin surface in the face of acid challenges, and form a stable layer on the surface of the dentin. NovaMin was compared to other marketed calcium-based products that claim tubule occlusion after a single treatment, a 10 day acid challenge looking at tubule occlusion, changes in surface hardness and calcium release. The authors concluded from the 4 experiments that NovaMin adheres to an exposed tooth dentin surface and reacts to form a mineralized layer. The layer is resistant to acid challenges and is strong mechanically. In addition, there is a continuous release of calcium over time and after four hours a higher release of calcium was observed providing for continual occlusion of the tubules.⁵⁷

In-office Treatments

Professional treatments are available for sensitivity cases that cannot be managed using over-the-counter products. Some in-office treatments include fluoride varnishes, prophylaxis pastes and laser treatments.

Fluoride Varnishes

The most popular in-office treatment is fluoride varnish, a resin-based fluoride. Various types are available. Fluoride varnish is primarily used to prevent tooth decay by entering the tooth enamel and making the tooth surface impenetrable.

The mode of action involves calcium fluoride being deposited on the tooth surface with the formation of fluorapatite.⁵⁹⁻⁶⁹ The varnish is applied after cleaning and drying the tooth surface. For caries protection, fluoride varnish is painted onto the tooth surfaces with a small brush. The varnish forms a sticky covering over the tooth and becomes hard as soon as saliva in the mouth touches it. Fluoride varnish prevents new cavities from forming and slows down or stops decay from progressing.

Many practitioners have begun using fluoride varnish as a desensitizing agent by applying the varnish to the exposed area to seal the dentin surface. Pashley et al., evaluated a series of commercial cavity varnishes and reported that all cavity varnishes tested decreased dentin permeability by 20 to 50%.⁶¹ In 2012, Camilotti et al. conducted a randomized, split-mouth clinical trial in 42 patients (252 teeth) presenting with dentin hypersensitivity to thermal changes in the mouth. The treatment groups were 4 fluoride varnishes (Duraphat, Fluorniz, Duofluorid Xii, and Fluorphat), a neutral fluoride (Flutop), a potassium oxalate gel (Oxa-gel) and a placebo which were all applied 3 different times with a time interval of one week between applications. Sensitivity reduction using air blast and clinical probing was evaluated at the end of 1 week, 2 weeks, 3 weeks and 30 days after the last application. The 4 fluoride varnish groups and the oxalate gel group had significantly lower pain scores compared to placebo at the 30-day reassessment; there were no significant differences between the 5 groups. The neutral sodium fluoride group was not significantly different from placebo, nor was it significantly different from Fluoriniz, Duoluorid XII, or Oxa-gel.⁶⁰

Fluoride varnish is easy to apply, low-cost and generally safe to use in the mouth, but should not be used if there is an allergy to one of the ingredients in the varnish.

Prophylaxis Pastes

Prophylaxis pastes with desensitizing agents are another professional treatment used for the relief of sensitivity. One example is paste containing 8% arginine (Pro-Argin), calcium carbonate, and 1450 ppm fluoride as sodium

monofluorophosphate (Colgate Sensitive Pro-Relief). Arginine, an amino acid naturally present in saliva, is reported to work in conjunction with calcium carbonate and phosphate to occlude dentinal tubules.⁷⁰⁻⁷⁶

Results from a 12-week clinical trial showed that 8% arginine-containing prophylaxis paste was statistically significantly more effective in reducing dentinal hypersensitivity than a control pumice prophylaxis paste (NuPro) immediately following application and after 4 weeks. No statistically significant differences were noted between treatment groups post-scaling and after 12 weeks.⁷⁰

In some markets outside the US, arginine is available in over-the-counter dentifrice and mouthrinse products.

Another prophylaxis paste for hypersensitivity relief contains sodium calcium phosphosilicate, marketed under the name of NovaMin®.^{77,78} Sodium calcium phosphosilicate occludes the dentinal tubules by forming a protective hydroxyapatite-like layer on the dentin surface. A number of clinical studies investigating the efficacy of NovaMin® for the relief of dentinal hypersensitivity have been conducted.⁷⁹⁻⁸²

Neuhaus et al., conducted a randomized, controlled, double-blind, parallel study with three treatment groups - sodium calcium phosphosilicate prophylaxis paste, with and without fluoride, and a control group - in 151 subjects meeting dentinal hypersensitivity entrance criteria.⁸³ Tactile and air blast assessments were completed at baseline and day 28. The results indicate that after a single professional application of sodium calcium phosphosilicate prophylaxis paste, hypersensitivity was significantly reduced immediately and 28 days after scaling and root planing procedures. The effect was independent from the presence of fluoride in the paste.

Lasers

Four different kinds of light amplification by stimulated emission of radiation (lasers) have been used for the treatment of dentinal hypersensitivity with effectiveness ranging from 5.2 to 100%, depending on the laser type and

parameters used.⁸⁴ The most common are: Nd-YAG (neodymium:yttrium-aluminum-garnet), GaAlAs (gallium/aluminum/arsenide) and Erbium-YAG (yttrium-aluminum-garnet) lasers.⁸⁵⁻⁸⁸ The mechanism of action of lasers in treating hypersensitivity is not very clear, but it has been proposed that the lasers coagulate the proteins inside the tubules and block the movement of fluid.

A 2011 systematic review of lasers for the treatment of sensitivity found only 3 randomized clinical trials for inclusion. The authors concluded that laser therapy can reduce dentinal hypersensitivity-related pain, but there is only weak evidence for its effectiveness and the placebo effect has to be taken into account.⁸⁹

Conclusion

Dentinal hypersensitivity is a common problem that affects many dental patients. When a

patient presents with dentinal hypersensitivity symptoms, they should be examined and informed of the treatment options available to alleviate the problem. The patient plays a role in this process since their daily habits may be contributing to the problem, and if not changed the condition may persist.

The initial cause of dentinal hypersensitivity, in the majority of cases, is recessed gingiva with the exposure of dentinal tubules. Once the tubules are exposed the patient is susceptible to pain in response to thermal, tactile, or osmotic stimuli. Desensitizing treatments should be delivered systematically.

Prevention and over-the-counter treatments, including desensitizing toothpastes, are a good place to start and can later be supplemented with in-office treatments if needed.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/professional-education/ce-courses/ce200/start-test

- 1. The prevalence of dentinal hypersensitivity has been reported over the years in a variety of ways; the variation in percentage is due to _____.**
 - A. Difference in populations
 - B. Methods of investigations
 - C. Not enough female participants
 - D. The wrong teeth being examined
 - E. A & B only
- 2. Dentinal hypersensitivity has been shown to peak in 20 to 30 year olds and then rise again when in their ____.**
 - A. 40s
 - B. 50s
 - C. 60s
 - D. 70s
- 3. Dentinal hypersensitivity has been researched extensively through the years and many authors express an agreement that dentinal hypersensitivity is _____.**
 - A. under-reported by the dental patient population
 - B. under-diagnosed
 - C. A & B
 - D. neither A nor B
- 4. The “hydrodynamic theory” is widely accepted as the cause of tooth sensitivity.**
 - A. True
 - B. False
- 5. Assumptions of the hydrodynamic theory conclude that when the fluids within the _____ are subjected to temperature changes or physical osmotic changes, the movement stimulates a nerve receptor sensitive to pressure, which leads to the transmission of the stimuli.**
 - A. hydroxyapatite
 - B. cementum
 - C. dentinal tubules
 - D. periodontal ligaments
- 6. Various stimuli that are reported to cause the transmission of sensation are _____.**
 - A. cold
 - B. hot
 - C. osmotic
 - D. A & B
 - E. A, B & C
- 7. The most important variable affecting the fluid flow in dentin is the pH of the stimulus.**
 - A. True
 - B. False

8. **A comprehensive dental examination will ultimately rule out potential underlying conditions where sensitivity is a symptom, EXCEPT one of the following. Which is the exception?**
- A. cracked tooth
 - B. fractured restoration
 - C. intrinsic tooth stain
 - D. dental caries
9. **The response to stimuli _____**
- A. is relatively constant among patients
 - B. varies from patient to patient
 - C. can be predicted based on gender
 - D. is directly correlated to the patient's age
10. **One of the most common reasons a dental patient would have exposed dentinal tubules is:**
- A. fluorosis
 - B. interproximal plaque
 - C. class II malocclusion
 - D. gingival recession
11. **Invasive treatments may include all the following EXCEPT one. Which one is the exception?**
- A. application of resins
 - B. use of home care OTC products
 - C. pulpectomy
 - D. gingival surgery
12. **Over-the-counter desensitizing dentifrices are considered to be simple, cost-effective and an efficacious first line of treatment for most patients.**
- A. True
 - B. False
13. **Stannous fluoride is a most widely available desensitizing toothpaste active ingredient. It works by _____.**
- A. occluding dentinal tubules by forming a smear layer at the surface
 - B. numbing the surrounding tissue
 - C. blocking the synapse between nerve cells, reducing nerve excitation and associated pain
 - D. None of the above.
14. **The following are examples of in-office treatments:**
- A. prophylaxis pastes with a desensitizing agent
 - B. fluoride varnishes
 - C. lasers
 - D. B & C
 - E. A, B & C

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