Dentin hypersensitivity: A review

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Abstract

Dentin hypersensitivity is diagnosed after elimination of other possible causes of the pain. Tooth sensitivity is a very common clinical presentation which can cause considerable concern for patients and clinicians. This condition is frequently encountered by periodontists, prosthodontists, hygienists and therapists. Desensitizing treatment should be delivered systematically, beginning with prevention and at-home treatments and then at-office treatments. This article reviews the various treatment strategies available for dentinal hypersensitivity.

Keywords: Dentin hypersensitivity; Desensitization; Hydrodynamic theory; Dentine plugging; Iontophoresis

Dentin hypersensitivity is characterized by short sharp pain arising from exposed dentin in response to stimuli—typically thermal, evaporative, tactile, and osmotic or chemical—that cannot be ascribed to any other dental defect or disease. The prevalence of dentin hypersensitivity is 60% to 90% in patients with periodontitis. It mostly occurs in patients who are between 30 and 40 years old and is prevalent in women. The condition may affect any tooth, but it most often affects canines and premolars. More than 90% of hypersensitive surfaces are at the cervical margin on the buccal or labial aspects of the teeth.

Under normal conditions, dentin is covered by enamel and does not suffer direct stimulation. Only with the exposure of the peripheral termination of dentin tubules, strong dentinal sensitivity is manifested. Teeth that are prepared for restorations, especially crowns, are at risk of developing hypersensitivity because a large number of tubules are exposed during preparation. It has been reported that approximately 1-2 million dentinal tubules are exposed during an average tooth preparation for posterior crown. Today, the hydrodynamic theory of dentin sensitivity is widely accepted.

The main etiological factors for dentin hypersensitivity are, gingival recession, periodontitis, endogenous acids arising from gastric acid reflux or regurgitation, wasting diseases like erosion, abrasion, attrition, cavity preparation and tooth preparations for restorations, abfraction, caused by ill-directed occlusal forces and exothermic heat produced during polymerization of self curing and light activated direct provisional crowns.

Theories for dentinal hypersensitivity

Odontoblastic transduction theory: According to this theory, odontoblastic processes are exposed on the dentine surface and can be excited by a variety of chemical and mechanical stimuli. As a result of such stimulation neurotransmitters are released and impulses are transmitted towards the nerve endings.

Neural theory: As an extension of the odontoblastic theory, this concept advocates that thermal or mechanical stimuli, directly affect nerve endings within the dentinal tubules through direct communication with pulpal nerve fibres.

Hydrodynamic theory: This theory was proposed by Brannstrom and it postulates that fluids within the dentinal tubules are disturbed either by temperature, physical or osmotic changes and that these fluid changes or movements stimulate a baroreceptor which leads to neural discharge. For examples, dehydration associated with dessication following air spray over the exposed dentin surface results in outward movement of dentinal fluid towards the dehydrated surface, which triggers nerve fibres and results in a painful sensation.

Management of dentin hypersensitivity: Treatments can be self administered by the patient at home or be applied by a dental professional in the dental office (Table 1). At home methods tend to be simple and inexpensive and in-office treatments are more complex. P.M. Bartold classified the treatment strategies for dentinal hypersensitivity as in Table 2.

At-home treatments

Desensitizing toothpastes/dentifrices: Most desensitizing toothpastes contain a potassium salt such as potassium nitrate at 5% or potassium chloride occlude the dentinal tubules and decrease the excitability of intradental nerves by altering their membrane potential. A product containing 5% potassium nitrate and 0.454% stannous fluoride in a silica base produced significantly greater reduction in dentin hypersensitivity. Some toothpastes containing sodium fluoride and calcium phosphate causes remineralization.

Table 1: DCNA Classification of treatment strategies

<table>
<thead>
<tr>
<th>Noninvasive</th>
<th>Invasive</th>
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<tr>
<td>Desensitizing toothpastes</td>
<td>Mucogingival surgery</td>
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<tr>
<td>Topical agents</td>
<td>Resins</td>
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Table 1:DCNA Classification of treatment strategies
Mouth washes and chewing gum: Mouthwashes containing potassium nitrate and sodium fluoride or a mixture of fluorides can reduce the dentin hypersensitivity.12, 13 The chewing gum containing potassium chloride significantly reduces the dentin hypersensitivity.

**In-office treatments**

A number of desensitizing agents have been used in office topically on the tooth surface to alleviate the pain caused by dentinal sensitivity.

**Nerve desensitization** (Potassium nitrate): Potassium nitrate at a concentration of 5% or 10% is topically applied via desensitizing toothpaste, adhesive gel or aqueous solution, and the potassium ions reduce the dentinal sensory nerve activity due to depolarizing activity of potassium ions.14

**Anti-inflammatory agents** (Corticosteroids): Corticosteroids have been used to reduce the dentin hypersensitivity, but, the validity of using such agents has been questioned.7

**Cover or plugging dentinal tubules**

a. **Plugging dentinal tubules**
   i. Ions/Salts: Calcium hydroxide, Potassium oxalate, Sodium fluoride, Sodium monofluorophosphate, Strontium chloride,
   ii. Protein precipitants: Formaldehyde, Glutaraldehyde, Silver nitrate
   iii. Casein Phosphopeptides
   iv. Iantophoresis
b. **Dentin sealers**: Glass ionomer cements, Composites, Resins, Sealants, Varnishes
c. Lasers
d. **Crown placement/restorative material**
e. **Periodontal soft tissue grafting**

Table 2 P.M.Bartold classification

Mouth washes and chewing gum: Mouthwashes containing potassium nitrate and sodium fluoride or a mixture of fluorides can reduce the dentin hypersensitivity.12, 13 The chewing gum containing potassium chloride significantly reduces the dentin hypersensitivity.

Oxalates: Pashley et al. states that depletion of the calcium ions from the acid etched surface dentin, forces the oxalate ions to diffuse further down into the dentinal tubule, until calcium ions are encountered for reaction. The calcium oxalates that are formed result in subsurface tubular occlusion and reduction in the hydraulic conductance of dentin. Thus they act by reducing the dentin permeability and by occluding the dentinal tubules.16

Calcium phosphates: They act by reducing the permeability of dentin and by occluding the dentinal tubules when applied topically.17, 18

Protein precipitants: Claims have been made that formaldehyde and glutaraldehydes precipitate salivary proteins in dentinal tubules, can be used to manage dentinal hypersensitivity.7

Gluma desensitizer: Gluma desensitizer consists of 36% HEMA, 5% glutaraldehyde and distilled water is very effective in reducing the dentin sensitivity by causing the peripheral occlusions of the exposed dentin.19

Iantophoresis: This procedure uses electricity to enhance diffusion of ions into the tissues. Dental iantophoresis is used often in conjunction with fluoride pastes or solutions and reduces the dentin hypersensitivity by plugging the dentinal tubules.20

Dentin sealers: Sealing the dentinal tubules with resins and adhesives has been advocated for specific and localized dentinal hypersensitivity but, not for generalized dentinal pain. These resins and adhesives include varnishes, bonding agents...
and restorative materials. Brannstrom claims that adhesive materials offer improved and longer-lasting desensitization.6

Lasers: The laser by interacting with the tissue causes different tissue reactions, according to its active medium, wavelength, power density and optical properties of the target tissue. According to literature, both red and infrared wavelength lasers have been effective in the treatment of dentin hypersensitivity. The lasers interaction with the dental pulp causes a photo biomodulating effect, increasing the cellular activity of the odontoblasts and obliterating the dentinal tubules with the intensification of tertiary dentin production.19 Thereza conducted a study to evaluate the effectiveness of 660 nm red laser and 830 nm infrared lasers in reduction of dentin hypersensitivity. Her study has proved that the 660 nm red laser is more effective than the 830 nm laser in reducing the dentin hypersensitivity. Studies have proved that lasers like Neodymium: Yttrium-aluminium-garnet (YAG) laser, the erbium and gallium-arsenide low level laser reduce the dentin sensitivity.1,2,21 But, the lasers are the most expensive and complex modality in treating the dentin hypersensitivity.

Crown placement/ restorative materials: This approach is reserved for a situation where there has been significant loss of tooth structure has occurred, as in tooth preparation for crowns and in cavity preparation for restorations. And, also as a last resort for a tooth which does not respond to other less invasive desensitizing protocols. Commonly used materials are glass ionomer cements, composite resins and methyl methacrylate temporary crowns.7

Periodontal surgery: There are numerous soft tissue grafting procedures which can be carried out to cover exposed root surfaces, include lateral sliding grafts, free gingival grafts and coronally positioned grafts.

Miscellaneous methods: If the dentin hypersensitivity is associated with an abfraction, due to ill directed occlusal forces, occlusal adjustment may be effective.1 If the dentin hypersensitivity is associated with exothermic heat that is produced in direct provisional crowns, can be reduced by air spray or removal of the provisional crown from the prepared tooth on initial polymerization of the resin.

Dentin hypersensitivity is relatively common and significant dental problem which can be successfully managed by a very wide variety of procedures, agents and formulations applied locally, either “in office” or “at home”. Most of the literatures have concluded that the combination therapy could be more effective in controlling the dentinal hypersensitivity rather a single therapy. The regimen adopted depends on the severity and localization of pain and number of teeth.

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