

# DENTINAL HYPERSENSITIVITY

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***Abstract:****The main aim of this review article is to provide information about Dentin Hypersensitivity(DH). Dentin Hypersensitivity ,a common condition of the teeth, characterized by short sharp pain arising from exposed dentinal tubules in response to stimuli. The article reviews its clinical features, pathogenesis, mechanism, diagnosis, prevention and management. The diagnosis should be accurate and all the differential diagnosis should be omitted. Desensitization remains the major choice for dentin hypersensitivity. The basic principle of treatment of dentin hypersensitivity is to block the patent tubules or block pulp nerve response.*

***Keywords:*** *Dentin hypersensitivity, hypersensitivity, short sharp pain, management, etiology, desensitization, sensitivity.*

## 1. Introduction

**Definition:** Dentin Hypersensitivity is defined as short, sharp pain arising from exposed dentin in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other dental defect or pathology.

Dowell and Addy 1983

**Common terms<sup>1</sup>:**

Dentin hypersensitivity/Sensitivity
Dentinal hypersensitivity/Sensitivity
Cervical hypersensitivity/Sensitivity
Root hypersensitivity/Sensitivity
Cemental hypersensitivity/Sensitivity

**Prevalence:**

It is more prevalent in patient with age 20-50 years. It is more prevalent in female individuals. The commonly affected site is buccal aspect of the cervical area<sup>2,3</sup>.

**Pathogenesis:**

1. Lesion localization
2. Lesion initiation

**Lesion localization:**

Dentinal tubules are exposed by attrition, abrasion, erosion and abfraction due to loss of enamel leading to loss of protective layer<sup>4</sup>.It can also occur due to gingival recession caused by toothbrush abrasion, pocket reduction surgery, tooth preparation crowns, excessive flossing or secondary to periodontal disease.

**Lesion initiation:**

For second phase, the localization should be initiated. It occurs after the tubular plugs and the smear layer are removed and dentinal tubules and pulp are exposed to external environment<sup>5</sup>.

**Mechanism:**

- Direct innervation theory(DI)
- Odontoblast receptor theory(OR)
- Fluid movement/Hydrodynamic theory

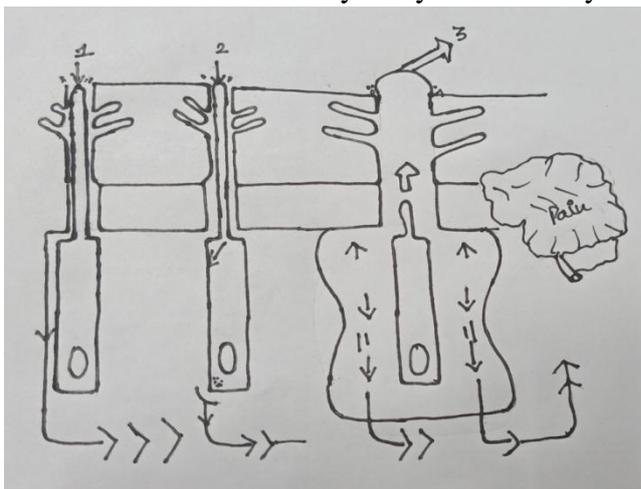


Fig.1 theories of dentin hypersensitivity:1)Neural theory:Stimulus applied to dentin causes direct nerve excitation of the nerve fibers;2) Odontoblastic transduction theory;Stimulus is transmitted along the odontoblast and passes to the sensory nerve endings through synapse;3)Hydrodynamic theory:Stimulus caused displacement of fluid present in dentinal tubules which further excite nerve fibers.

**Direct innervation theory:**

Direct innervation theory reports that the nerve endings penetrate dentin and extend to DEJ, in which the mechanical stimuli directly transmit the pain<sup>6</sup>.Until the tooth erupts,the plexus of Rashkow and intratubular nerves do not establish. However the new erupted tooth can be sensitive too<sup>7</sup>.

### **Odontoblast receptor theory(OR):**

Signals to the pulpal nerves are transmitted by odontoblasts which act a receptor. Since the cellular matrix of odontoblastsis not capable of exciting and producing neural impulses this theory also been rejected<sup>8</sup>.

### **Hydrodynamic theory:**

Hydrodynamic theory proposed by Brannstorm is the most widely accepted theory for dentin hypersensitivity. According to him, when an appropriate stimulus is applied to the other dentin surface there is displacement of the fluid in the dentinal tubules.

It claims that tubules are open between dentin surface which is then exposed to environment and pulp<sup>9</sup>. The intensity of the stimuli form A-delta intradental afferent fibers arise from the pulpal nerves. These stimuli include cooling, drying, evaporation and application of hypertonic chemical substances<sup>10</sup>.

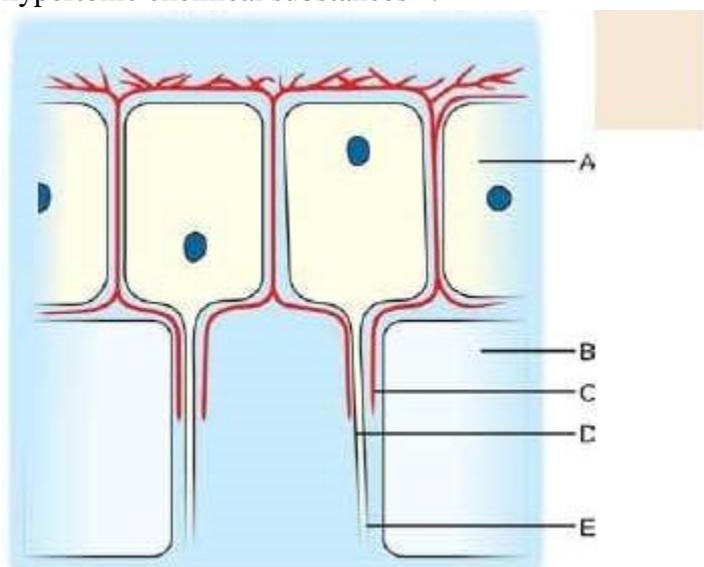


Fig 2: A) Odontoblast  
B) Dentin  
C) A-delta fiber  
D) Odontoblastic process  
E) Stimulation of A-delta fiber from fluid movement

### **Clinical features:**

The patient present with complain of pain with discomfort, inability to brush the teeth,pain on application of stimuli including cold air, acidic drinks. The degree of pain varies in character, ranging in intensity from mild discomfort to extreme severity which may emanate from single tooth or several teeth. The most common teeth to get affected is first premolar and canine<sup>11</sup>.

### **2. Dignosis:**

Conditions similar to Dentin hypersensitivity includes dentinal caries, fractured or chipped enamel, pain as a result of irreversible pulpitis and post bleaching sensitivity<sup>1</sup>. Definite diagnosis should be made after excluding all conditions causing dental pain. Dentin hypersensitivity can be diagnosed in a simple clinical method by jet of air or using an exploratory probe on the exposed dentin,after inspecting all teeth which the patient complains of pain in the meso distal direction<sup>12</sup>. By using visual analogue scale or categorical scale,the severity of the pain can be quantified as slight, moderate or severe pain<sup>1</sup>.

Individuals at the risk of dentin hypersensitivity includes<sup>12</sup>:

- Overenthusiastic brushers
- Periodontal treated patients

- Bulimics
- People with xerostomia
- High acid food/drink consumers
- Older people exhibiting gingival recession
- Chewing “smokeless” or “snuff” tobacco

**Removal of etiological factors:**

1. Improper tooth brushing: The patient should be taught about proper brushing technique to avoid dentin hypersensitivity. After consuming acid drinks or foods the patient should avoid brushing for atleast for one hour and patient should avoid using of abrasive tooth pastes<sup>1,3</sup>.
2. Premature contacts: This can be resolved by use of occlusal splint or by correction of occlusion<sup>12</sup>.
3. Gingival recession
4. Exogenous and endogenous acids(erosive agents)
5. Poor oral hygiene causes periodontal disease leading to root exposure.

**Classification of desensitizing agent<sup>10,13,14</sup>:**

A. Mode of administration:

- At home desensitizing agents
- In office treatment

B. On the basis of mechanism of action

- Nerve desensitization e.g., potassium nitrate
- Cover or plugging dentinal tubule
  - ✓ Aluminium
  - ✓ Ammonium hexafluorosilicate
  - ✓ Calcium hydroxide
  - ✓ Calcium phosphate
  - ✓ Calcium carbonate
  - ✓ Calcium silicate
  - ✓ Ions/salts
  - ✓ Fluorosilicate
  - ✓ Sodium citrate dibasic
  - ✓ Potassium oxalate
  - ✓ Silicate
  - ✓ Sodium Monofluorophosphate
  - ✓ Sodium fluoride
  - ✓ Sodium fluoride/Stannous fluoride combination
  - ✓ Stannous fluoride
  - ✓ Strontium acetate with fluoride
  - ✓ Strontium chloride
- Protein precipitate
  - ✓ Formaldehyde
  - ✓ Glutaraldehyde
  - ✓ Silvernitrate
  - ✓ Strontium chloride hexahydrate
- Phytocomplexes
  - ✓ Rhubarb Rhaponicum

- ✓ Spinacia oleracea
- ✓ Fluoride iontophoresis

C. Dentin Sealers

- Glass ionomer cements
- Composites
- Dentinal adhesives
- Resinous dentinal desensitizers
- Varnishes
- Sealants
- Methyl Methacrylate

D. Periodontal soft tissue grafting

E. Lasers

F. Homeopathic medications

- Plantago major
- Propolis

**At home desensitizing methods:**

Tooth pastes and tooth dentrifices:

The major role of desensitizing agent is to occlude the dentinal tubules. Nowadays , desensitizing toothpaste mostly contain potassium chloride, potassium citrate and potassium nitrate which have a positive effect on DH<sup>4</sup>. Soft bristled tooth brush should be used and the patient should be educated to use minimum water so that the toothpaste have maximum effects<sup>3</sup>.

Recent studies shows tooth pastes and powders contain arginine. It contains 8% arginine, calcium carbonate and 1450ppm fluoride forming an alkaline atmosphere, leading to precipitation of salivary calcium and phosphate in the dentinal tubules<sup>15</sup>.

Desensitizing mouthwash, chewing gum can be used along with toothpaste and powders containing potassium nitrate, sodium fluoride or potassium citrate After 2-4 weeks ,the patient should be reviewed for the result of “at home” therapy. If there is no decline in pain of DH, the patient should start the next stage “in-office” therapy<sup>1,3</sup>.

**In-Office treatment:**

The In- office desensitizing therapy theoretically should provide immediate relief. They are classified as<sup>1</sup>:

1. The material that don't undergo a setting reaction eg-oxalates, varnishes
2. The material that undergo setting reaction eg-composites
3. Lasers

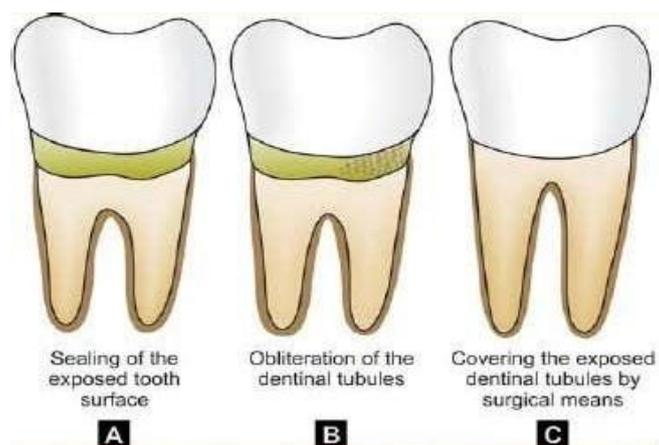


Fig 3: In office treatment for dentin hypersensitivity

**Potassium nitrate:**

Available as adhesive gel and aqueous solution. By the axionic action of intra dentinal fibers the potassium ions decrease the nerve excitability that transmit pain<sup>3</sup>.

**Fluorides:**

Fluoride has effectiveness in reducing dentin hypersensitivity by precipitating the calcium fluoride crystals which are mostly insoluble inside the dentinal tubules<sup>16</sup>. Various other formulations used to treat DH include sodium fluoride, stannous fluoride, Sodium monofluorophosphate, fluorosilicates and fluoride combined with iontophoresis<sup>1</sup>. Because of precipitation and acid decalcification fluorides are used to treat DH.

**Oxalates:**

Oxalates reduce dentinal hypersensitivity by occluding the dentinal tubules. Calcium of dentin react with oxalates forming calcium oxalate in the inside as well as outside of the dentinal tubules thus resulting in sealing of the intact smear layer . since the effect of oxalates reduces due to use of acidic foods the condition can be reversed by etching of the dentinal surface to increase the penetration of crystals into the dentinal tubules<sup>17</sup>. Since Potassium oxalate leads to digestive disorder it should not be use for long term<sup>8</sup>.

**Varnishes:**

Varnishes provide passage for other materials in their therapeutic effect. Copal varnishes covers the exposed dentinal tubules. Since it has short effectiveness it has to be applied more times<sup>18</sup>. Fluoride varnishes are also used which acts by combining with acid to increase the effectiveness by penetration of ions.

**Adhesive materials:**

Inspite of its short effect the adhesive materials have long or permanent action or effect. It includes bonding agents, varnishes, resin composites. The hybrid layer formed by old adhesive is by etching the dentinal surface through removing the smear layer<sup>19</sup>. The deep dentinal resin tags were formed by conventional dentin bonding agents(DBA). Hybrid layer is termed as combination of penetrating resinous tags in Dentin- resin layer<sup>20</sup> . Recently, Gluma shows good results in management of DH in clinical trials<sup>21</sup>.

**Bioglass:**

Bioglass stimulates bone formation during periodontal surgery to fill osseous defects<sup>20</sup>. Formulation of bioglass promotes dentinal tubules remineralization and infiltration<sup>22</sup>. The basic component silica act as nucleation site for calcium and phosphate precipitation. Occlusion of dentinal tubules are formed by formation of apatite layer by bioglass<sup>22</sup>.

**Laser:**

Acronym for Laser is LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION. Mechanism of action, its effect on dentine and reducing DH includes<sup>23</sup>:

- I. Occlusion by coagulation of proteins of fluid inside dentinal tubules
- II. Occlusion of tubules by partial sub melting
- III. Discharging of internal tubular nerve

**Recent advances:**

Arginine, an amino acid occurring naturally in saliva and calcium carbonate provide relief for DH. Pro-Argin contains 8% arginine and calcium carbonate seal dentinal tubules which are exposed. It has been suggested that Pro Argin mouthwash or paste provide relief for dentin hypersensitivity<sup>24,25,26,27</sup>.

NovaMin<sup>®</sup> contains 15% Calcium Sodium PhosphoSilicate (CSPS) is based on bioglass technology. The CSPS releases sodium ions resulting in rapid formation and precipitation of calcium hydroxyapatite mineral layer on the dentin surface in aqueous environment. It is effective only as an in office treatment<sup>28</sup>.

Recent advance in nanotechnology uses three layered guided tissue regeneration for DH with localized gingival recession<sup>29</sup>.

**Casein phosphopeptide amorphous calcium phosphate:**

Milk protein casein is used as a remineralizing agent. The casein phosphopeptide (CPP) contains phosphoserine gets attached and stabilized with amorphous calcium phosphate (ACP)<sup>30</sup>.

**3. Conclusion:**

To conclude, Dentin hypersensitivity is a common dental complaint, and prior to treatment a differential diagnosis is critical. Identification of the various risk factors should be ascertained and a determination should be made of whether the pain is localized or generalized. Unfortunately, most currently available tests are subjective. Ideally, a more objective technique is required in order to adequately quantify patients response.

**4. Discussion:**

Dentin hypersensitivity as a chronic disease is increasingly prevalent among adults and some researches has been done on determining etiologic factors in the causation of the disease, its diagnosis, and its treatment. This disorder usually occurs as the result of the loss of enamel and cementum or exposure of dentinal tubules. There have been many methods and materials to reduce or remove sensitivity. They include the use of tubes of toothpaste containing potassium salts, fluoride composites, resins, laser; bioglass, and so on. They exert their effects by sealing dentinal tubules or by disturbing the transmission of nerve impulses. Etiologic factors have been underestimated by dentists or specialists in the treatment of DH. Based on studies, different theories have been proposed on the dentin hypersensitivity, in which direct innervation theory and odontoblast receptor theory had some challenges. However, Hydrodynamic theory by Brannstrom deals with the flow of fluid inside the dentinal tubules is readily accepted. Still, the most common therapy and usually the first therapy in treating dentin hypersensitivity is the use of kinds of toothpaste containing potassium salts and fluoride. The new offered materials and methods, such as bioglasses, CPP-ACP, laser, iontophoresis, and homeopathy for the treatment of DH have been tested through studies and the obtained results have been different. The use of laser in the treatment of dentin

hypersensitivity is more recommendable among patients. Moreover, the use of it has no negative impact and this is promising.

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