Review Article

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DENTIN HYPERSENSITIVITY AND ITS MANAGEMENT: A REVIEW

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ABSTRACT

Dentinal hypersensitivity is a very common clinical condition of the teeth, which is characterized by short sharp pain arising from exposed dentin in response to stimuli, there are number of theories of which Brannstrom hydrodynamic theory is most widely accepted. The condition generally involves the facial surfaces of the teeth near the cervical aspect & is very common in premolars & canines.

KEYWORDS: Dentinal hypersensitivity; etiology; desensitizing agent; management

INTRODUCTION

Dentinal hypersensitivity is defined as an exaggerated response to a stimulus that usually causes no response in a healthy tooth & also an exaggerated response to a non harmful stimulus. The non harmful stimuli are the thermal, tactile or osmotic stimuli that when applied on the exposed dentin, evoke pain without causing pathologic alteration to the dentin-pulpo complex. A modification of this definition is suggested by the Canadian advisory board on Dentinal hypersensitivity in 2003 which suggested that disease should be substituted for pathology. The definition provides the clinical description of the condition & identifies Dentinal hypersensitivity as a distinct clinical identity.[1,2,3]

Epidemiology

About 8 to 30% of the population present Dentinal hypersensitivity & the most affected age is 20-40 yrs. The first premolar are the most affected teeth reaching more than half of the teeth & the most affected region is the cervical area of the buccal surface.[2]

Pathogenesis

It has been stated in the literature that Dentinal hypersensitivity develops in two phases:

- Lesion localization
- Lesion initiation

Lesion localization

It occurs by loss of protective covering over the dentin which leads to exposing it to external enviornment. It include loss of enamel via-attrition, abrasion, erosion. Another cause of lesion localization is gingival recession which can be due to tooth brush abrasion, pocket reduction surgery, tooth preparation for crown, excessive flossing or secondary to periodontal diseases.[4]

Lesion initiation

It occurs after the protective covering of smear layer is removed leading to exposure & opening of dentinal tubule.[4]

Mechanism

The intradentinal nerve are confined to the pre dentin & the most pulpal part of dentin. This support the likelihood of an indirect stimulatory mechanism evoking pain several theories have been put forward to explain the mechanism of dentinal hypersensitivity.[5,6] They are-

1. Transduction theory: It states that odontoblast act as a receptors by themselves & rely signal to a nerve terminal, but majority of studies have concluded that odontoblsts are matrix forming cells & hence they are not considered to be excitable cells.
2. Modulation theory: According to this theory the nerve impulses in the pulp are modulated through the liberation of polypeptide from the odontoblast when injured. These substance ay selectively alter the permeability of odontoblastic cell membrane through hyperpolarization. So that pulp neurons are

more prone to discharge upon receipt of subsequent stimuli.

3. Hydrodynamic theory: According to Brannstrom hydrodynamic theory when an appropriate stimulus is applied to the outer dentin surface there is displacement of the fluid of dentinal tubule that give rise to the mechanical stimulation of the pain at the pulpodentinal border.

Diagnosis

Diagnosis of dentinal hypersensitivity starts with a thorough clinical history & examination. A simple clinical method of diagnosing dentinal hypersensitivity includes the jet of air or using an exploratory probe on the exposed dentin, in a mesiodistal direction,by examining all the teeth. The severity or degree of pain can be quantified either according to categorical scale or using a visual analog scale.[7-11]

Principles of Management strategy

Some of the strategy which could be helpful for the management of dentinal hypersensitivity are as follows:

- Removal of etiological & pre-disposing factors
- Patient with mild to moderate hypersensitivity should be adviced at home desensitizing therapy
- Patient with severe hypersensitivity treatment should be initiated in office
- Prevention measure should be given importance & patient should be followed up regularly

Classification of desensitizing agent [9,10,12,13]

1. Mode of administration
   - At home desensitizing agents
   - In office treatment
2. On the bases of mechanism of action
   - Nerve desensitization e.g., potassium nitrate
   - Cover or plugging dentinal tubule
     - ❖ Ions/salts
     - ❖ Aluminium
     - ❖ Ammonium hexafluorosilicate
     - ❖ Calcium hydroxide
     - ❖ Calcium phosphate
     - ❖ Calcium carbonate
     - ❖ Calcium silicate
     - ❖ Sodium citrate dibasic
     - ❖ Fluorosilicate
     - ❖ Potassium oxalate
     - ❖ Silicate
     - ❖ Sodium Monofluorophosphate
     - ❖ Sodium fluoride
     - ❖ Sodium fluoride/stannous fluoride combination
     - ❖ stannous fluoride
     - ❖ strontium acetate with fluoride
     - ❖ strontium chloride
   - Protein precipitants
     - ❖ formaldehyde
     - ❖ glutaraldehyde
     - ❖ silvernitrate
     - ❖ strontium chloride hexahydrate
     - ❖ Zinc chloride
   - Phytocomplexes
     - ❖ Rhubarb Rhaponicum
     - ❖ Spinacia oleracea
     - ❖ Fluoride iontophoresis

(B) DentinSealers

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

(C)Periodontal soft tissue grafting

(D) Lasers

(E) Hoemeopathic medications

- Plantago major
- Proplis

At home Desensitizing Agent

The advantage of this mode is that it is simple and can be used in number of teeth. The disadvantage is that about 2-4 week of tie symptom may reoccur. Some of the desensitizing agents that can be used at hoe are tooth paste, mouth wash, chewing gums ,containing potassium nitrate, sodium fluoride or potassium citrate can be recommended.[1,5,7,9,14]

In office treatment

- Theoretically, the in office desensitizing therapy should provide in immediate relief. The agent used for office treatment can be classified as:
  a) The material that don't undergo a setting reaction eg- oxalate, varnishes
  b) The material that undergo a setting reaction eg . composite

c) Lasers can also be used to manage dentinal hypersenstivty.

Potassium nitrate

It has been reported that the potassium salts move along the dentinal tubules & decrease the excitability of the tooth by blocking the axonic action of the intra-dental nerve fibers. The agents reduce the excitability of nerves that transmit pain. Toothpastes which contain 5% potassium nitrate along with other ingredient have been reported to be effective in reducing dentine hypersensitivity.

Calcium hydroxide

Calcium hydroxide is effective in managing dentinal hypersensitivity. It acts by occlusion of dentinal tubules through the binding of loose protein radicals by calcium ions & additionally increases the mineralization of the exposed dentine.

Fluorides

The desensitizing effects of fluoride are probably related to precipitated fluoride compounds which mechanically block the dentinal tubules or fluoride within the tubules which mechanically block the tansmission of stimuli. The improvement with fluoride appears to be due to an increase in the resistance of dentine to acid decalcification as well as due to precipitations in the exposed dentinal tubules.

Oxalates

Oxalate produce desensitizing by deposition of calcium oxalate crystals on the surface of dentine .It reacts with calcium of dentine & leads to deposition of calcium oxalate crystals on the surface of dentine & / or inside its tubules. The surface of the tooth can be etched to increase the effectiveness of oxalate.

Strontium-containing dentifrices

The strontium salts like acetate or chloride, penetrate the tubules & occlude them. This reduces the sensitivity by preventing the fluid movement.

Calcium sodium phosphosilicate

Laboratory studies have shown amorphous sodium calcium sodium phosphosilicate, to occlude dentin tubules through the deposition of particles which react to form a protective layer, on the dentin surface. Calcium sodium phosphosilicate bioactive glass containing toothpastes have been shown to significantly reduce dentin hypersensitivity.

Formaldehyde or glutaraldehyde

These precipitate the salivary proteins in dentinal tubules & can be useful in the management of dentinal hypersensitivity. These agents should be used with extreme caution,as they are strong tissue fixatives.

Adhesive material

The adhesive resins can seal the dentinal tubules effectively by forming the hybrid layer. Various studies have demonstrated the effectiveness of resin in management of dentinal hypersensitivity.

Newer bonding agent modify smear layer and incorporate it into hybrid layer, recently some bonding agent have been introduced in the market with the sole purpose of treating dentinal hypersensitivity. Like gluma desensitizer.[3,5,8,11]

Varnishes

They help other materials to increase their therapeutic effect. Fluoride varnishes combine with acid to increase its effectiveness. Slow & continuous release of fluoride occurs with fluoride varnish. Calcium fluoride gets deposited on the tooth surface, resulting in the formation of fluorapatite. Copal is used to cover exposed dentine. chlorhexidine-containing varnish forms a mechanical barrier after drying. This reduces sensitivity, & provides an antibacterial & antiplaque action.[6,9]

Restorative materials

Composite resins & glass ionomer restorations are commonly used restorative materials. The restorations can seal the open dentinal tubules as well as restore the tooth to full contour.[2,7,10]

Bioglass

It has been reported that the formulation of bioglass can promote infiltration and remineralization of dentinal tubules. The basic component is silica, which act as a nucleation site for precipitation of calcium and phosphate. Some products have been reported such as novamin.[3,5,9]

Portland cement

Some authors have shown that calcium derived from Portland cement can help in the management of dentinal hypersensitivity. It helps to occlude the dentinal tubules by remineralization.[5,7,10]

Periodontal surgery

Several soft tissue grafting procedures like lateral sliding grafts ,free gingival grafts, connective tissue grafts & coronally repositioned flaps can be

carried out to cover exposed root surfaces. These procedures may cover exposed dentinal tubules, but are not very predictable in terms of efficacy to cover root surface.[10,12]

Laser

It has been shown in various studies that lasers can be used in the effective management of dentinal hypersensitivity some authors have shown that Nd-YAG laser application occluded the dentinal tubules. GaA1A laser is thought to act by affecting the neural transmission in the dentinal tubules. It has also been proposed that laser coagulate the protein inside the dentinal tubules and block the movement of fluid.[12,13]

Casein phosphopeptide –amrphous calcium phosphate

Recently milk protein casein has been used to develop a remineralizing agent (gc tooth mousse).the casein phosphopeptide contains phosphoseryl sequences which get attached and stabilized with amorphous calcium phosphate.[14,15]

CONCLUSION

Dentinal hypersensitivity is a 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”. It is clear that some products appear to be more effective than others. For those products developed for self application at home, potassium nitrate, stannous fluoride, sodium fluoride, sodium monofluorophosphate and strontium chloride have all been extensively studied and shown to be not only safe to use but of benefit to individuals suffering fro dentinal hypersensitivity.

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