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"DENTINE HYPERSENSITIVITY: A REVIEW"

Dental Science

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ABSTRACT

Dentine hypersensitivity (DH) is one of the most common clinical problems which can cause considerable discomfort to the patients. Once initiated it can cause sensitivity or can trigger pain and create severe discomfort for the patient. Gingival recession and enamel loss both, resulting in the exposure of dentine, contribute to the prevalence of this condition. Dentine hypersensitivity is believed to occur due to the movement of fluid within the dentinal tubules occurring in response to thermal, chemical, tactile and evaporative stimuli, in accordance with Brannstrom's Hydrodynamic Theory. Its management requires a good understanding of the complexity of the problem, there are a variety of treatments available to treat DH. This review describes the etiology, incidence and management of dentine hypersensitivity.

KEYWORDS:

dentine hypersensitivity, dentinal tubules, gingival recession

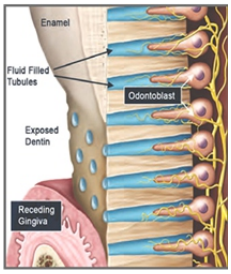
Introduction:

Dentine hypersensitivity (DH), is described clinically as an exaggerated response to non-noxious stimuli and satisfies all the criteria to be classified as a true pain syndrome.[1] Dowell and Addy have defined dentine hypersensitivity as a transient pain arising from exposed dentine, typically in response to chemical, thermal, tactile or osmotic stimuli, which cannot be explained as arising from any other form of dental defect or pathology.[2] DH can affect people of any age group but the majority of affected people have been reported to be in their third and fourth decade of life.[3] Some studies have suggested that DH affects more women than men. DH prevalence has been reported to be 60- 98% in patients having history of periodontal disease. [4]

Mechanism of dentine hypersensitivity

A number of theories have been put forth in recent years to explain the mechanism of dentine hypersensitivity. The most widely accepted theory till date is called the Hydrodynamic theory. This theory was first put forward or postulated by Gysi in the year 1900 and was later developed by Brannstrom (1963).[5] It was proposed in this theory that application of external stimuli, such as cold or hot, tactile or osmotic pressure, to exposed dentine will cause movement of dentinal fluid. The movement of the fluid in turn will stimulate the mechanoreceptors which are near the base of the dentinal tubules and under the influence of certain parameters; a pain response will be triggered.[6] Note the outward flow of fluid in response to stimuli, represented by the black arrows shown in fig. 1.

Fig. 1: Brännström's Hydrodynamic Theory



Etiological and predisposing influences

There are numerous and varied etiological factors for and predisposing to dentine hypersensitivity. Certainly, no prime cause can be identified. By definition, dentine hypersensitivity may arise as a result of loss of enamel and/or root surface denudation with exposure of underlying dentine. Gingival recession due to chronic periodontal disease is thought to be a very important etiological factor associated with DH.[7] Moreover, Dababneh et al. (1999) suggested that hypersensitivity which occurs in association with periodontal disease might have an etiology which is different from the etiology of DH occurring alone i.e. because of possible penetration of dentinal tubules by bacteria. [8]

Some of the etiological and predisposing factors associated with DH have been summarized in Table 1.

Table 1. Etiological and some predisposing factors associated with dentin hypersensitivity[9]

Loss of enamel
Denudation of cementum
Gingival recession
Attrition
Abrasion
Abfraction
Erosion (intrinsic and extrinsic)
Tooth malposition
Thinning, fenestration, absent buccal alveolar bone plate
Periodontal disease and its treatment
Periodontal surgery
Patient habits

Differential Diagnosis[10]

It is worth to note that although many individuals seem to have exposed dentine, not all end up experiencing its symptoms. For those who do, it is important to eliminate other possible causes of patient's pain by considering a differential diagnosis such as:

1. Chipped teeth
2. Fractured restorations
3. Pulpal response to caries
4. Pulpal response to restorative treatment
5. Cracked tooth syndrome
6. Palatogingival groove

Diagnosis

Diagnosis of DH starts with a thorough clinical history and examination Clinical signs and symptoms that a dental professional should be aware of and inquire about include sensitivity or pain when a stimulus is applied (such as hot/cold/sweet/sour/touch), exposed

dentine at the site of sensitivity, and in the absence of dental caries, fracture lines, or poor restorations. A simple clinical method of diagnosing DH includes a jet of air or using an exploratory probe on the exposed dentine, in a mesio-distal direction, examining all the teeth in the area in which the patient complains of pain. The severity or degree of pain can be quantified either according to categorical scale (i.e., slight, moderate or severe pain) or by using a visual analogue scale.

Prevention and treatment of DH

Treatment of hypersensitivity essentially involves the reduction of the functional diameter of the dentinal tubule to limit its fluid movement. This can be achieved by:

1. Formation of a smear layer by burnishing the exposed root surface.
2. Topical application of agents that form insoluble precipitates within the tubules.
3. Impregnation of tubules with plastic resins.
4. Applications of dentine bonding agents/adhesives that seal the dentinal tubules.

Educating the patient on the causes and management of dentine hypersensitivity is a primary goal for dental professionals when creating a treatment plan for this condition. There are multiple etiologies and once the main cause has been identified, education is the next step, which may entail behavior modifications. (Table 2).

Table 2. Patient education
Causes of dentine hypersensitivity
Instructions on toothbrushing technique and when to brush.
Advice on toothbrush type - avoid medium and hard bristles
Advice on appropriate use of toothpaste.
Advice on technique for interdental cleaning
Dietary advice (avoiding carbonated beverages, acidic foods and drinks)
Hypersensitivity associated with tooth whitening.

Various desensitising agents are used for dentine hypersensitivity. Grossman[11] suggested the following **ideal requirements** for a satisfactory desensitizing material:

1. Non-irritant to the pulp
2. Relatively painless upon application
3. Easily applied
4. Rapid in action
5. Effective for a long time
6. Devoid of staining elements
7. Consistently effective.

Classification of desensitizing agents [12]

I. **Mode of administration**

- Home use desensitizing agents
- In-office treatment

II**. On the basis of 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

Dentine adhesive sealers
- Fluoride varnishes
- Oxalic acid and resin
- Glass ionomer cements
- Composites
- Dentine bonding agents

Lasers
- Neodymium: Yttrium Aluminum Garnet (Nd–YAG) laser
- GaAlAs (Galium–Aluminium–Arsenide laser)
- Erbium–YAG laser

Homeopathic medication
- Propolis

Home-use treatments

Mild, generalized dentine hypersensitivity can usually be managed well with at-home treatment. They are cost-effective, safe, non-invasive and simple to use. These at-home treatments come in a variety of applications including dentifrices, gels, or rinses and are incorporated into the daily oral home care regimen. Home-use treatments for dentine hypersensitivity fall into the two categories defined by their mechanism of action.

1. Interfering with neural transmission
   The most popular ingredient in over-the-counter dentifrices that affect neural transmission is 5% potassium nitrate, this concentration is recognized by the FDA for this ingredient. Potassium salts act by diffusion along the dentinal tubules and decrease the excitability of the intradental nerve fibers by blocking the axonic action.[13,14] There are a number of dentifrices containing 5% potassium nitrate. All of these products contain fluoride ions as well for protection against caries. (Sensodyne, Crest Sensitivity, Colgate Sensitive, Biotene Sensitive Toothpaste with Dry Mouth Protection).

2. Tubule occlusion
   One of the main active ingredients used in this manner is fluoride. When fluoride is applied to exposed dentine, precipitation occurs and blocks the dentinal tubules. Fluoride dentifrices effectively relieve dentine hypersensitivity by occluding the dentinal tubules. Calcium and phosphate precipitates formed following use of dentifrices containing calcium and phosphate technologies, have also been found to relieve hypersensitivity, including CPP-ACP, ACP and calcium sodium phosphosilicate.

In-office desensitizing agents

Theoretically, the in-office desensitizing therapy should provide an immediate relief from the symptoms of DH. The in-office desensitizing agents can be classified as the materials which undergo a setting reaction (glass ionomer cement, composites) and which do not undergo a setting reaction (varnishes, oxalates). Products that have been used include resin-based materials, sodium fluoride varnish, silver fluoride solution, oxalates, and an aqueous solution of glutaraldehyde and hydroxyethylmethacrylate. These products generally occlude and seal the exposed dentinal tubules.

Iontophoresis, a technique that utilizes a low galvanic current to accelerate ionic exchanges and the precipitation of insoluble calcium with fluoride gels, has also been suggested as a means of occluding the open dentinal tubules. [15]

Arginine- $CaCO_3$ is also used as an active ingredient in a professionally used prophy paste to manage dentine hypersensitivity. A clinical study [16] on 390 patients in Hong Kong found that professional prophylaxis by dentists and dental hygienists using Arginine-CaCO3 paste could significantly reduce dentine hypersensitivity. Furthermore, dentists may apply a dental sealant and cavity varnish to cover the exposed dentine surface. In conditions where enamel and/or dentine is lost due to abrasion, erosion and/or abfraction leaving a notching of the root, filling materials such as glass ionomer and composite resin can be used to cover the exposed root and restore the tooth morphology. Besides topical application of various products, other clinical treatment methods have also been used. Lasers can be used either alone or with surface treatments, such as topical fluoride application, to manage dentine hypersensitivity.

Conclusion

Dentine hypersensitivity can be a challenging condition for dental practitioners to diagnose and treat effectively. With the advancement in dental products, options for providing relief from pain and sensitivity are great and vary according to the severity of the condition. Dental practitioners should be more aware and effective in asking patients questions about sensitivity. With practitioners being more pro-active with this condition, patients may not need to experience the pain associated with hypersensitivity. However, if they do have this condition, they can certainly receive treatment that can provide relief

from pain.

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