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Dentinal Hypersensitivity- A Common Cold of Dentistry: A Review

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ABSTRACT

Dentinal hypersensitivity is generally reported by the patient after experiencing a sharp pain caused by one of several different stimuli. The pain response varies substantially from one person to another. The condition generally involves the facial surfaces of teeth near the cervical aspect and is very common in premolars and canines. The most widely accepted theory of how the pain occurs is Brannstrom's hydrodynamic theory, fluid movement within the dentinal tubules. The dental professional, using a variety of diagnostic techniques, will discern the condition from other conditions that may cause sensitive teeth. Treatment of the condition can be invasive or non-invasive in nature. The most inexpensive and efficacious first line of treatment for most patients is a dentifrice containing a desensitizing active ingredient. This review will address the prevalence, diagnosis, and treatment of dentinal hypersensitivity.

Introduction

The term dentinal hypersensitivity has been used for many decades to describe a common painful condition of the teeth. Despite this there are many gaps in our knowledge concerning dentinal hypersensitivity. It is perhaps not surprising therefore that one can still have sympathy with statement made in 1987 by *Johnson and Co-workers* that dentinal hypersensitivity is an Enigma, being frequently encountered yet ill understood.

Definition

Dentinal hypersensitivity is characterized by short, sharp pain arising from exposed dentine in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical and teeth can not be ascribed to any other form of dental defect or pathology.

Etiology

Two processes need to occur to cause dentinal hypersensitivity.[6]

- Lesion localization
- Lesion initiation

A. Lesion localization: **dentine has to become exposed.**

Causes: Enamel loss and Gingival recession

Enamel loss

E.g. attrition**,** abrasions and erosion abfraction may act as predisposing or co-destructive factors.

2. Gingival recession - multifactorial etiology

Cause: Tooth brushing

ANUG and ANUP, Self- inflicted injury, periodontal disease, periodontal surgical and non-surgical procedures, Dehiscence / fenestrations.



Fig 1: Gingival recession

b. Lesion Initiation

- Require opening of dentinal tubules
- Studies in vitro suggests that most tooth paste remove the smear layer through abrasive and detergent actions
- Erosive agents, particularly acid dietary fluids readily expose tubules. Erosion of dentine appears to being about rapid loss of the smear layer and the opening of dentinal tubules.

Mechanism of action

Three theories have been proposed.

Direction neural stimulation

According to this theory the dentinal tubules innervated by nerves, which extend upto 100 microns along the dentinal tubules. Whenever there is injury to these dentinal tubules, the stimuli reach the nerve ending in the inner dentine. The stimulated nerve causes hypersensitivity. Since histological examination shows the dentinal tubules does not contain any nerve endings, this theory is not accepted.[1]

2. Transduction theory

Membrane of the odontoblast process is excited by the stimulus and the impulse is conduct to the nerve ending in the inner dentine i.e. pre-dentine, odontoblast zone and pulp .Not popular theory since there is no neurotransmitter vesicles in the odontoblast process to facilitate the synapse or synaptic specialization.[1]

3. Hydrodynamic theory

Various stimuli such as heat, cold, air blast desiccation, or mechanical or osmotic pressure affect fluid movement in the dentinal tubules. This fluid movement, either inward or outward, stimulates the pain mechanism in the tubules by mechanical distribution of the excess closely associated with the odontoblast and its process. (Thus these ending may act as mechanoreceptors as they are affected by mechanical displacements of the tubular fluid).This increase flow causes a pressure changes across the dentine, which activates A-delta intradental nerve at the pulp dentine border or within the dentine tubules. The stimulus is thought to occur via a mechanoreceptor response that distorts the pulp nerves. When fluid moves in tubules, an electrical discharge known as streaming potential occurs, with is directly proportional to pressure. To accept this theory, the lesions must have dental tubules open at the dentine surface and patent to the pulp.[2]

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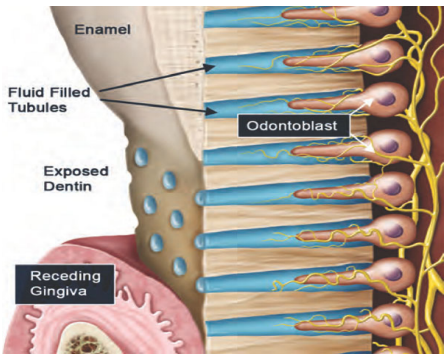


FIG 2: HYDRODYNAMIC THEORY

Clinical assessment of dentine hypersensitivity
Subjective Evaluation
Verbal rating scales

- Described by Keele (1948).
- Has 4-point scale grading pain as slight, moderate, severe and agonizing.

Visual Analogue Scale (VAS)
- It is a line, 10 cm in length.
- The extremes of the line representing the limits of pain a patient might experience from an external stimulus. i.e. at one end – no pains.
- Other end – most sever pain.
- Patient are asked to place a mark on the 10 cm line which indicates the intensity of their current level of sensitivity/ discomfort following application of test stimuli.

Objective assessment
1. Mechanical / Tactile stimuli

1. Explorer probe
2. Mechanical pressure stimulation.
- Developed by Smith and Ash (1964)
- Consists of 15 mm stainless steel wire with a fine tip point and capable of movement across the buccal surface of sensitive tooth. The scratching force could be increased by means of a small screw used to move the tip closer to or away from the root surface.
- Probing involves moving the wire across the exposed root surface, increasing the scratching force, measured in millimeter, until a painful response is elicited. [8]

3. Yeaple Probe
- Is a electronic pressure sensitive device
- Consist of a dental explorer and the handle with in approximately the size of a fountain pen and is connective to a control panel. The probe is designed to deliver a preset force when the tip is applied perpendicular to the cervical labial surface. The force may be varied by regulating the current.
- Once the pre-set force is reached a red light shows on the control panel and available signal is activated. The force may be varied usually in 5 gm steps, until the patient experiences discomfort. If maximum force of 70g is reached without any perceived disconfirmation, then the tooth is scored as non-sensitive.[7]



FIG 3: YEAPLE PROBE

2. Chemical / osmotic stimulation
- Hypertonic solutions. Eg. Sodium chloride glucose, sucrose and calcium chloride.
- The use of chemical solution is complicated, because the solute in solution diffuses into the dentine fluid. On repeated applications, the osmotic pressure difference between the tubular fluid and the applied fluid will decrease and reduce the effect of the solution as our osmotic stimulus.

3. Electrical stimulation
1. Electrical pulp tester

Is a battery operated, producing pulses of direct current. The intensity of the output voltage may be increased by pre-setting various numbered gradations (0-10) on a thumb wheel.

2. Dental Pulp Stethoscope
- Developed by *Stark et al (1977)*
- Consisted of a digital readout sensitive voltameter connected to a digital printer teeth was activated by push button control. A conventional battery powered electrical pulp tester was attached to the Voltameter.

4. Dehydrating and evaporative stimuli.

Cold air blast
- 20°C air blast for 1 second is used to elicit dentine hypersensitivity.

Air thermal system
- A temperature-controlled stream of air at 10 psi was directed on to the exposed dentine via disposable plastic tip. An initial air temperature of 100°F was progressively lowered until a positive response was elicited from the patients or until the lower limit of O°F was obtained. Air temperature is controlled by passing through the compressor. [7]

3. Air jet stimulator
- Developed by *orchardson and collius (1987)*
- Consists of controlled jet of air (20°C +/- 1°C) from compressed air supply. The flow of air is regulated by flow meter. It is activated by foot switch, which diverts airflow to the tooth and started a three-decade digital clock. When patient feels discomfort switch off (hand operated) which automatically stops the clock.

4. Temptronic device
- It is a microprocessor temperature controlled air delivery systems.
- Here air temperature can be varied in the range of –5°C to +85°C.
- Airflow in regulated at constant rate of 60 psi.

5. Thermal stimulation
- Cold water testing: varied temperature of 15 ml of water is rinsed.
- Thermo-electric device (Biomat-thermal probe)
- Ice – stick.
- Heat or cold air.
- Ethyl chloride.

Management
A. *Home use products*

Home use 'over the counter' desensitizing products appear to be the most realistic and practical means of treating most patients with tooth dentine hypersensitivity and should be the 1st step in routine management.[4]

Classification
According to Scherman A and Jacobeen – 1992.
Based on chemical and physical properties as follows.

Chemical agents ***Physical agents***

Corticosteroids
Silver nitrate
Strontium chloride
Formaldehyde
Potassium nitrate or oxalate
Fluorides
Sodium citrate
Iontophoresis with 2% NaF
Composites
Resins
Varnishes
Sealants
Soft tissue grafts
Glass inomer cement
Lasers

B. IN-OFFICE PRODUCTS

All in-office treatments are designed to decrease the hydraulic conductance of dentine by partial or complete tubule occlusion. [3]

I. Treatment agents that do not polymerize.

a. Varnishes / Precipitants

- Shellacs
- 5% NaF varnish
- 1% sodium fluoride, 0.4% stannous fluorides
- 3% mono-potassium-monohydrogen oxalate
- 6% acidic ferric oxalate
- Calcium phosphate preparations.
- Calcium hydroxide.

b. Primes containing HEMA (Hydroxy ethyl methacrlate)

- 5% glutaradehyde
- 35% HEMA in water

II. Treatment agents that undergo setting or polymerization reactions. [5]

- Conventional glass ionomer cement.
- Resin-modified glass ionomer cement / Compomers
- Adhesive resin primers
- Adhesive resin bonding system.

III. Use of mouth guards.

IV. Iontophoresis.

V. Lasers.

Prevention of dentinal hypersensitivity

I. Suggestions for patients

- Avoid hard bristled tooth brushes without end rounded bristles
- Practicing good oral hygiene techniques.
- Avoid brushing teeth immediately following ingestion of acidic food or beverages.
- Avoid over brushing with excessive pressure for prolonged period of time.
- Avoid excessive flossing or incorrect use of other interproximal cleansing devices.
- Avoid picking at the gums or using tooth picks in-appropriately.

II. Suggestion for professionals.

- Avoid over instrumentating the root surfaces during calculus removal and scaling and root planning.
- Avoid violating the biologic width placing crown margins causing subsequent recession.
- Avoid over polishing the exposed roots during stains removal.
- Avoid burning the gingival tissue during in-office tooth whitening or bleaching procedures.

CONCLUSION

The increase in longevity of dentition through periodontal therapy and plaque control procedures may increase the incidence of dentine hypersensitivity. The ultimate goal in the treatment of dentinal hypersensitivity is the immediate and permanent relief of pains. Conventional desensitizing agents often produce unsatisfactory results, since the action is usually directed toward the occlusion of the opened dentinal tubules without considering the causative factors that created the problem. Once the definitive diagnosis of dentinal hypersensitivity has been made after considering a differential diagnosis, a careful assessment of the etiologic factors must be considered, which in turn if identified and correctly managed may enhance the outcome of the currently used desensitizing agents and ensure more successful management.

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