

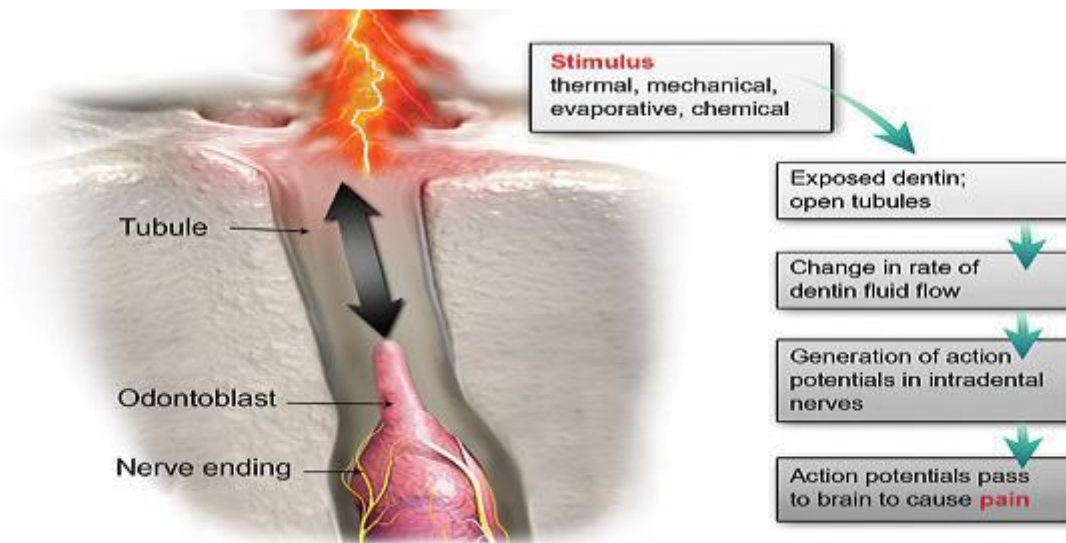
DENTINAL HYPERSENSITIVITY

Dr. Abier Abdulsattar

DGP4

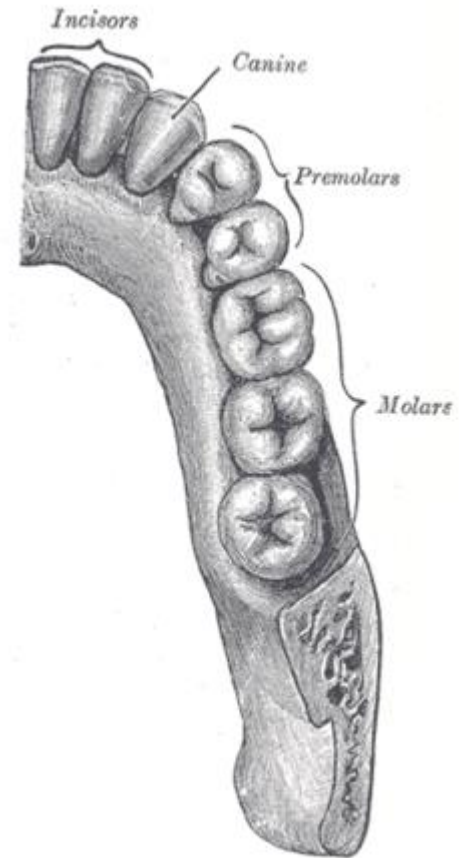
Dentinal Hypersensitivity (DH)

- Is characterized by short sharp pain arising from exposed dentine in response to stimuli most commonly thermal (hot or cold), can also be evaporative, tactile or chemical and which cannot be ascribed to any other form of dental defect or pathology / disease . A modification of this definition was suggested by the Canadian Advisory Board on Dentine Hypersensitivity, in 2003, which suggested that 'disease' should be substituted for 'pathology'. This definition challenges clinicians to consider other potential causes for pain associated with tooth sensitivity. Many conditions share the symptoms of tooth sensitivity, so a differential diagnosis is essential.

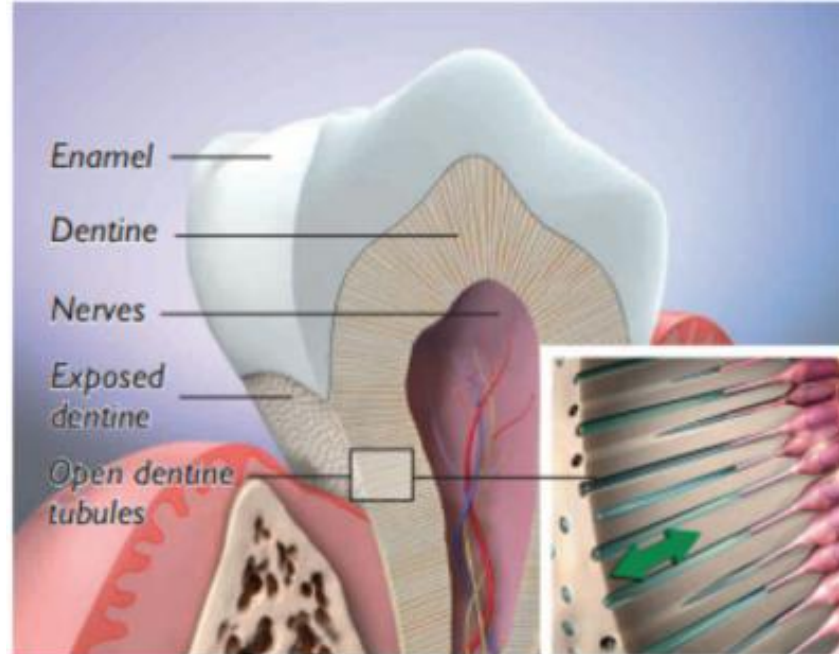


Epidemiology of Dentinal Hypersensitivity

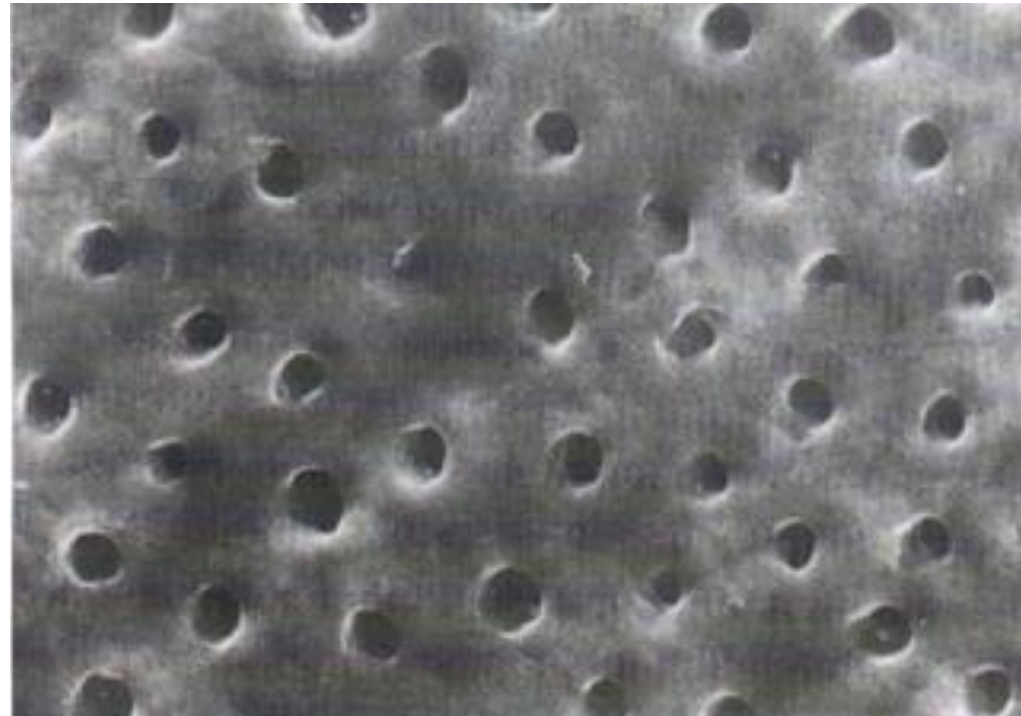
- Dentinal hypersensitivity appears to be a common problem with various reports indicating an incidence of between 4% -74 % of the population, it mostly occurs in patients who are between 30 and 40 years old, although it may affect patients of any age.
- One reason for this large discrepancy relates to the variations in the methods of data collection (for example, questionnaires or clinical examinations).
- The condition may affect any tooth, but it most often affects canines and premolars; the affected teeth tend to vary among studies and populations.



- The prevalence of DH is between 60%- 98% in patients with periodontitis.
- Between 9% and 23% of patients have reported root sensitivity before root planing, while after deep scaling & root planing approximately 55% of patients have reported experiencing **transient dentinal hypersensitivity** (for 1-3 weeks).
- Hypersensitivity also may occur after tooth whitening and restorative procedures



- In order for patients to develop dentinal hypersensitivity, two processes must be in place: First, the dentin has to be exposed (lesion localization). Second, the dentinal tubule system has to be opened and be patent to the pulp (lesion initiation).

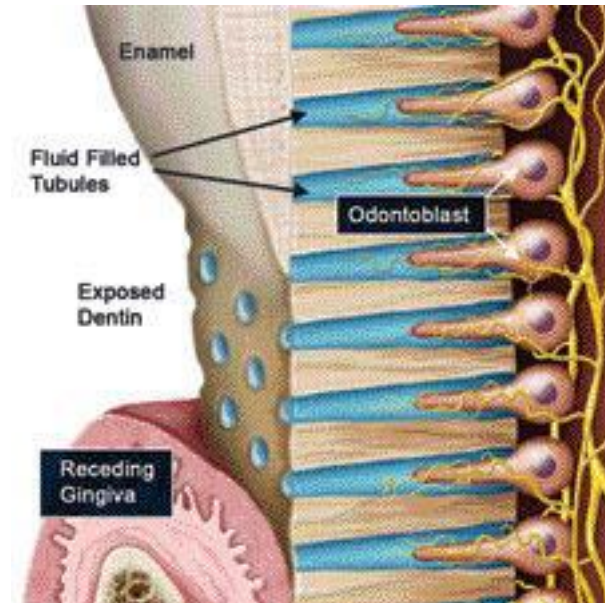


Lesion Localization:

- First, lesion localization occurs by exposure of dentin, either by loss of enamel or by gingival recession. Gingival recession is the more important of these two factors. More than 90 % of hypersensitive surfaces are at the cervical margin on the buccal or labial aspects of the teeth.

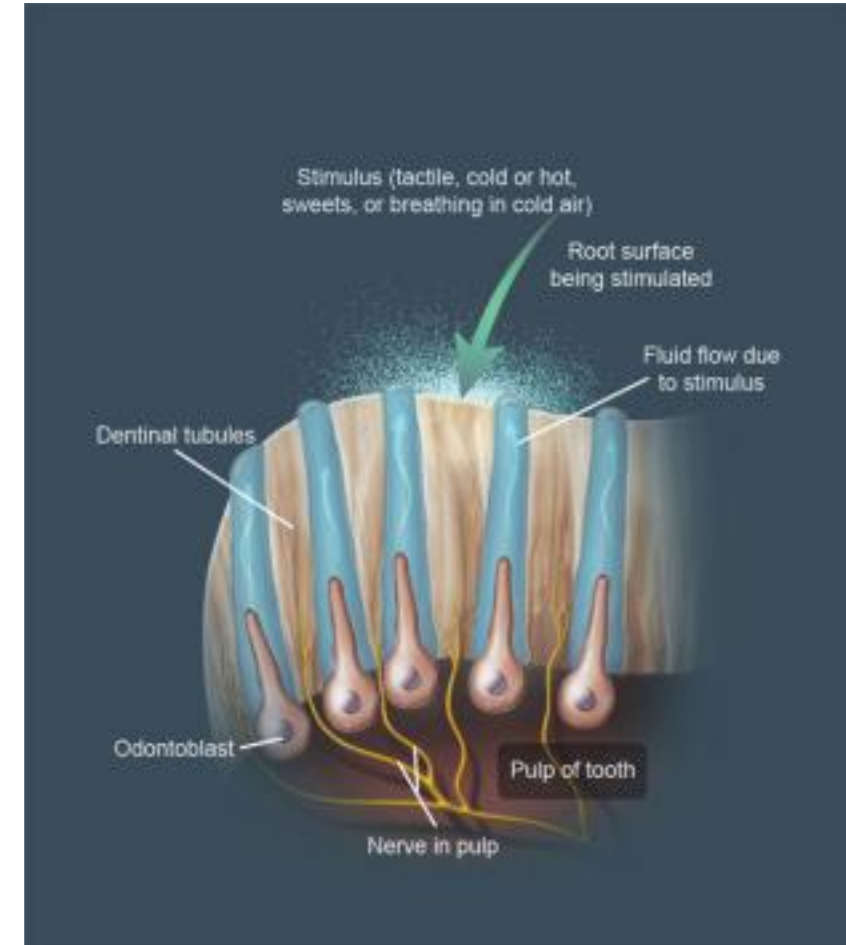
Lesion Initiation:

- Not all exposed dentin is sensitive. The localized DH lesion must be initiated. This occurs when the smear layer or tubular plugs are removed, which opens the outer ends of the dentinal tubules. The dentin tubules must be open to both the oral cavity and the pulp.



Theories For Dentinal Hypersensitivity

- Several theories have been cited throughout the years to explain the mechanism involved in dentinal hypersensitivity, including:
 - The Odontoblastic Transducer Theory.
 - The Modulation Theory.
 - The Gate Control Theory.
 - The Hydrodynamic Theory.



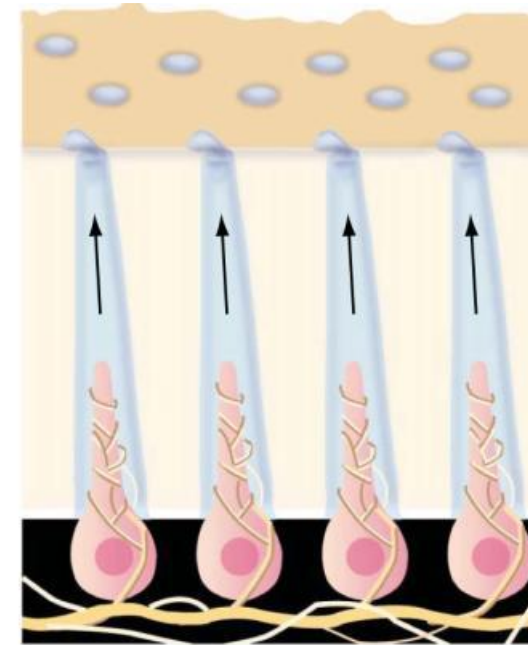
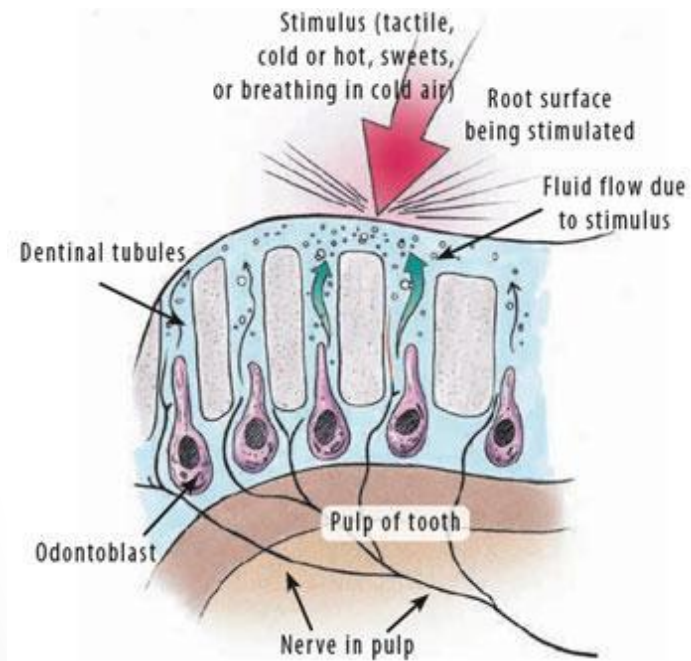
Brännström's Hydrodynamic Theory

- By far the most widely accepted theory for dentinal hypersensitivity, proposed by Brannstrom and co-workers.(1962,1966)
- This theory 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 example, dehydration of exposed dentin (blast of air or dry absorbent paper) over the exposed dentine surface results in outward movement of dentinal fluid towards the dehydrated surface, which triggers nerve fibers “mechanoreceptor” and results in a painful sensation.

- Heat application to dentin will result in an expansion of the fluid and cold application will result in a contraction of the fluid, with both creating an excitation of the mechanoreceptor and eliciting pain.
- When high osmotic stimuli such as sugar, acid or salt solutions were placed in contact with exposed dentin will result in fluid flow within the dentinal tubules toward the higher concentration eliciting a pain response.



- Physical stimulation is more difficult to explain through this theory although it is possible that mechanical abrasion of the exposed dentine surface may be sufficient to induce unwanted fluid flow within the dentinal tubules.



Note the outward flow of fluid in response to stimuli, represented by the black arrows.

In a study among Australian dentists (Amarasena 2011), cold and air stimuli were reported as the most frequent triggers for dentine hypersensitivity.

Triggers

Stimuli	%	n
Cold	80,1 %	920
Air	23,2 %	266
Touch	20,7 %	238
Hot	13,0 %	149
Dietary acid	6,9 %	79
Endogenerous acid	0,7 %	8
Other	6,1 %	70

Etiology of Dentinal Hypersensitivity

Gingival recession and enamel loss

Gingival recession and enamel loss have multiple causes that result in cementum and/or dentin exposure.

Some common causes of **gingival recession** include;

- **Physiological causes , patients age.** The increase in the number of teeth with root exposure is evident as age advances.
- **The anatomy of the labial plate of the alveolar bone** (tooth anatomy and tooth position may affect the thickness of the labial plate of alveolar bone).
- **Toothbrush abrasion/ excessive oral hygiene** (the frequency, duration and force of brushing contribute to recession). Excessive force and improper technique may lead to gingival irritation that over time can also lead to recession, patients with better home care have shown greater amounts of gingival recession compared to those with poorer home care .
- Periodontal disease and surgery .

- **Poor oral hygiene** (plaque induced gingivitis may lead to periodontitis & attachment loss if inadequate plaque control continues).
- **Frenum attachment** (frenal pull that results in the tissue moving more towards the cemento-enamel junction may result in recession).

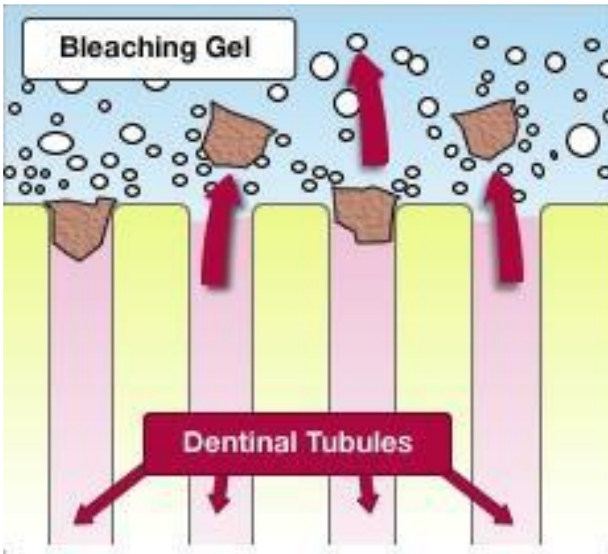
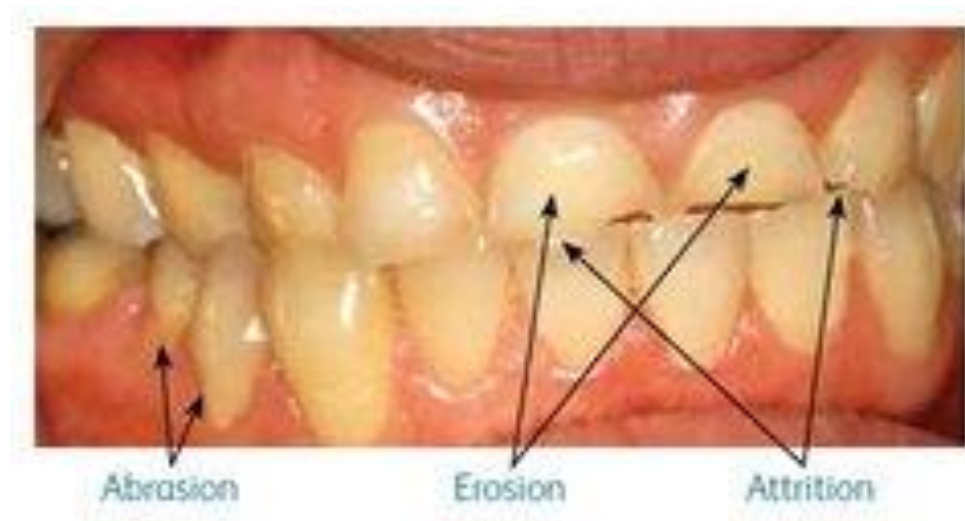


Fig. 1 Oxygenating bleaching gels that remove the micro-debris within tooth structure will also remove the plugs in dental tubules



Loss of enamel results in exposed dentin and therefore is associated with dentinal hypersensitivity

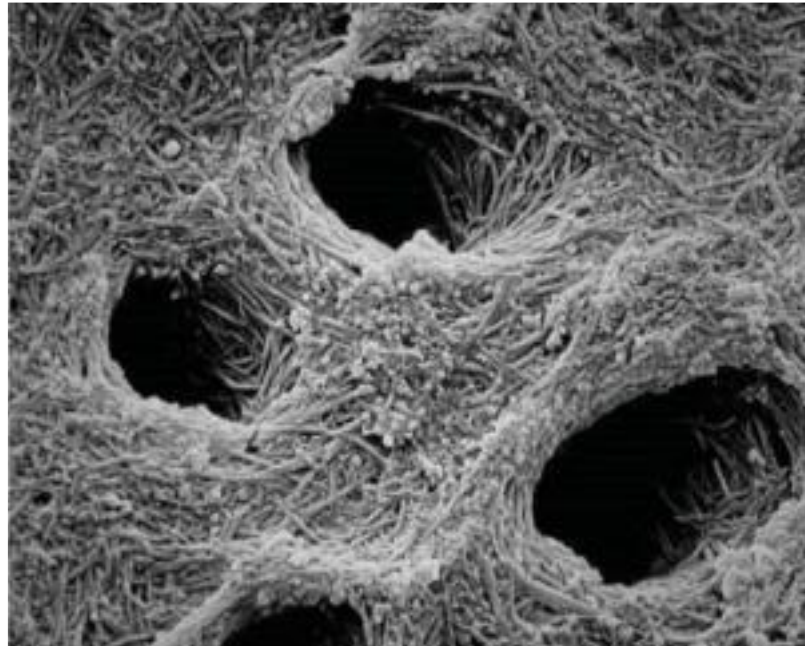
- Abrasion: is defined as the mechanical removal of hard tissue by the repeated introduction of foreign bodies into the oral cavity that are in contact with the teeth(Imfeld T. ,1996).
- Attrition: Attrition is the physiological wearing away of dental hard tissue through tooth to tooth contact, without the intervention of foreign substances (Imfeld T. ,1996).
- Erosion: Erosion is commonly defined as the loss of the dental hard tissues without bacterial involvement and involves dissolution by acids of non bacterial origin (Barbour ME, Rees GD. 2006).



dentalhealth.ie

Examination and Diagnosis

- A diagnosis of DH should be determined only when the practitioner has considered differential diagnoses after conducting a methodical history and examination of the patient.
- DH is defined as a transient tooth pain arising in response to stimulation.
- The other causes of transient tooth pain must be excluded for a diagnosis of DH to be made.



Diagnosis

- A simple clinical method of diagnosing DH includes a jet of air or using an exploratory probe on the exposed dentin, 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 using a visual analogue scale.

Tactile test: An explorer was gently run across the affected surface of the tooth



Air blast test: A blast of air from a dental syringe



Cold water test: Ice cold water in a disposable 1-cc syringe was slowly expelled onto the tooth surface



Differential Diagnosis

Dental caries

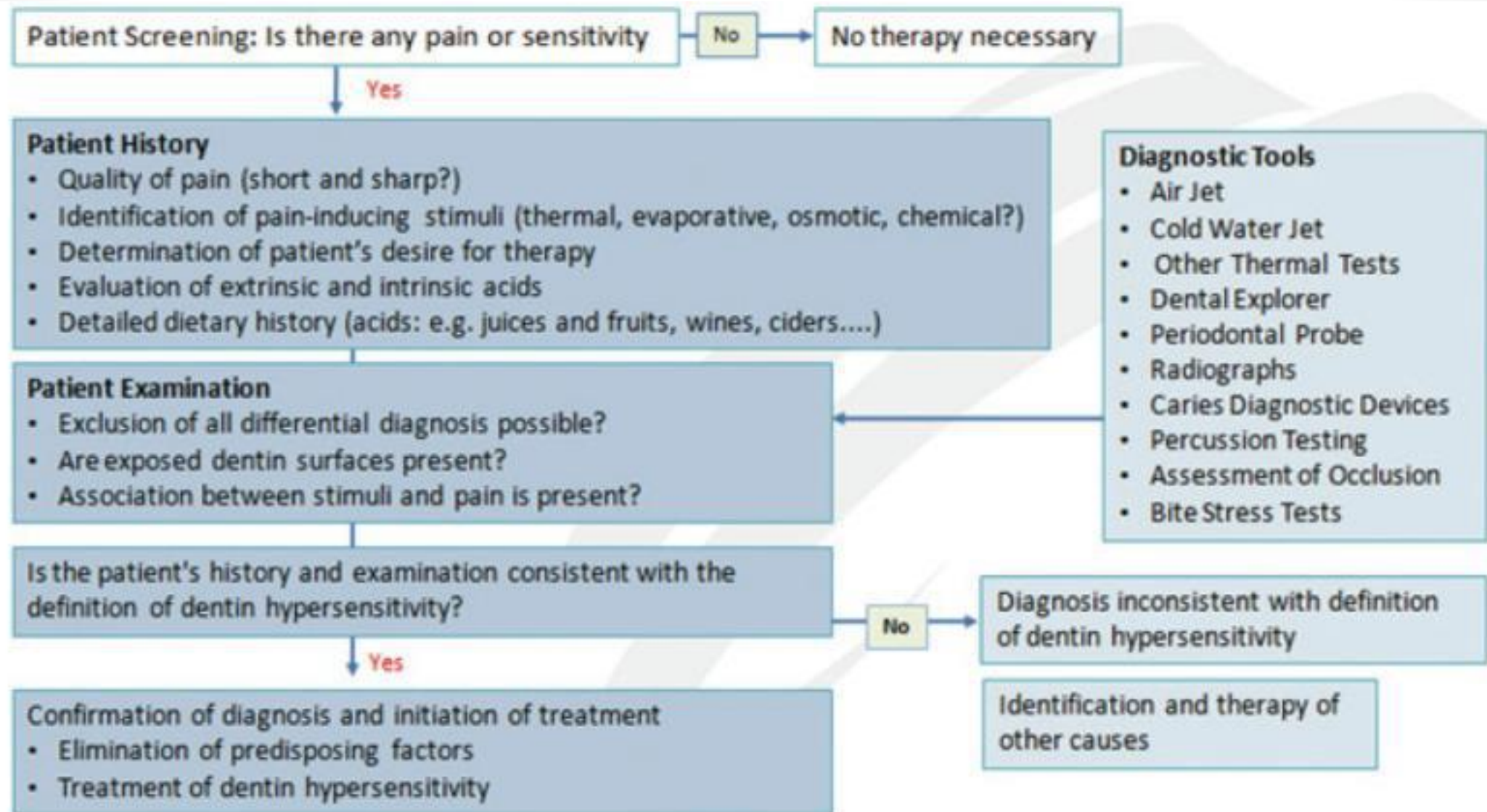
Fractured teeth

Cracked teeth

Fractured restorations

Leaking restorations

Pulpal pathology



Nature of pain and not quality of pain

Fig 1: Effective diagnosis of dentine hypersensitivity.⁵

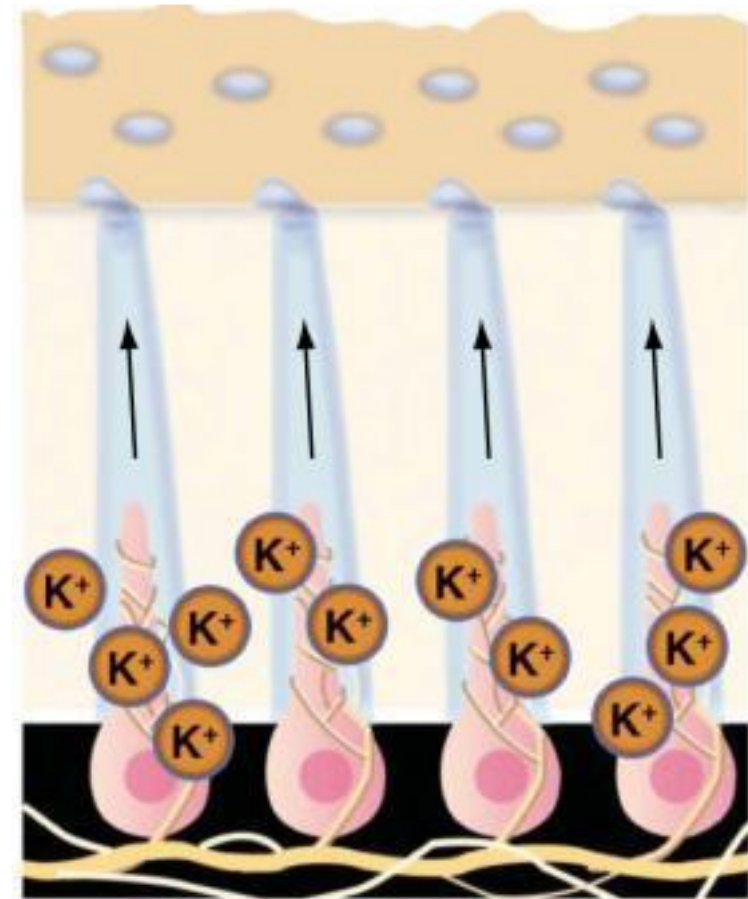
Treatment

- In 1935, Grossman reported some requirements of ideal treatment for DH, which can still be applied nowadays.
 - ✓ The treatment must act fast,
 - ✓ be effective for long periods,
 - ✓ be easy to apply,
 - ✓ not irritate the pulp,
 - ✓ not cause pain,
 - ✓ Not stain the teeth
 - ✓ and be constantly effective.

- Desensitizing agents have been classified according to their mode of action
- According to their chemical or physical properties
- It is perhaps easier to classify them by their mode of administration: at home or professional

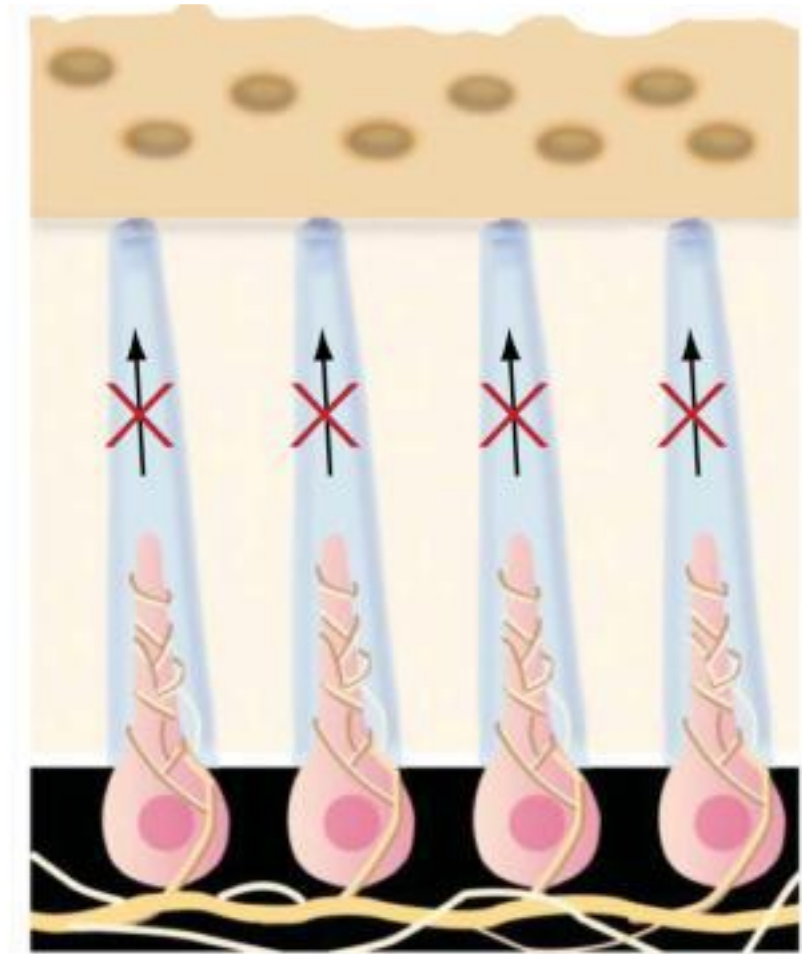
AT-HOME TREATMENTS

- Home-use desensitizing products are divided into two categories;
 - ① Products that block the pulp nerve response.
 - ② Products that occlude open dentinal tubules.
- Products that block the pulp nerve response contain **potassium salts**, that **diffuse inside the dentinal tubules and lower the excitability of the pulpal nerves** (arguments, diffusion distance in human teeth is great, flow of dentinal fluid is outward from pulp toward tooth surface)(most popular is potassium nitrate 5%)



Note the outward flow of fluid is still present in response to a stimulus; however, neural transmission in response to this is prevented by the presence of extracellular potassium.

- The products that occlude open dentinal tubules (to block the hydrodynamic mechanism in the dentine tubules) work by two ways, either the deposition of an occluding layer on top of the dentine OR the introduction of an occluding material into the dentinal tubules.
- Patients must be aware that the home-use treatments will not prove to be effective unless used continuously for at least 2-4 weeks.



Note the occlusion of the dentinal tubules, preventing the outward flow of fluid and subsequent stimulation of nerve fibers.

Summery of substances that occlude dentine tubules

<u>Substance</u>	<u>Effect</u>
Strontium (chloride, acetate)	Absorb onto the connective tissue of dentine and form stronium apatite
Stannous fluoride	Stannous fluoride precipitates onto dentine
Calcium sodium phosphosilicate	Precipitate onto dentine collagen as calcium phosphate and silicate that is deposited on the dentine surface and in dentinal tubules.
Fluorides	Enhance the mineralization of hydroxyapatite within the dentinal tubules
Arginine and calcium carbonate	Occlude dentinal tubules with calcium phosphate deposits
Oxalates	Form calcium oxalate crystals within the dentine tubules

IN-OFFICE TREATMENTS

- Dental professionals can deliver a wider range of more complex and more potent desensitizing treatment.

Cavity varnishes

Treatments that partially obturate dentinal tubules Burnishing of dentin

Silver nitrate

Zinc chloride–potassium Ferro cyanide

Formalin

Calcium compounds

- Calcium hydroxide
- Dibasic calcium phosphate

Fluoride compounds

- Sodium fluoride
- Stannous fluoride

Iontophoresis

Strontium chloride

Potassium oxalate

Restorative resins

Dentin bonding agents

Cavity Varnishes

- It has been observed that dentin becomes insensitive if a thin film of a varnish is applied topically over the exposed dentin surface, but this is reported to provide only temporary relief.
- The varnish application is painless and adheres to the teeth for hours or days.
- The coating effect induces immediate relief of pain.

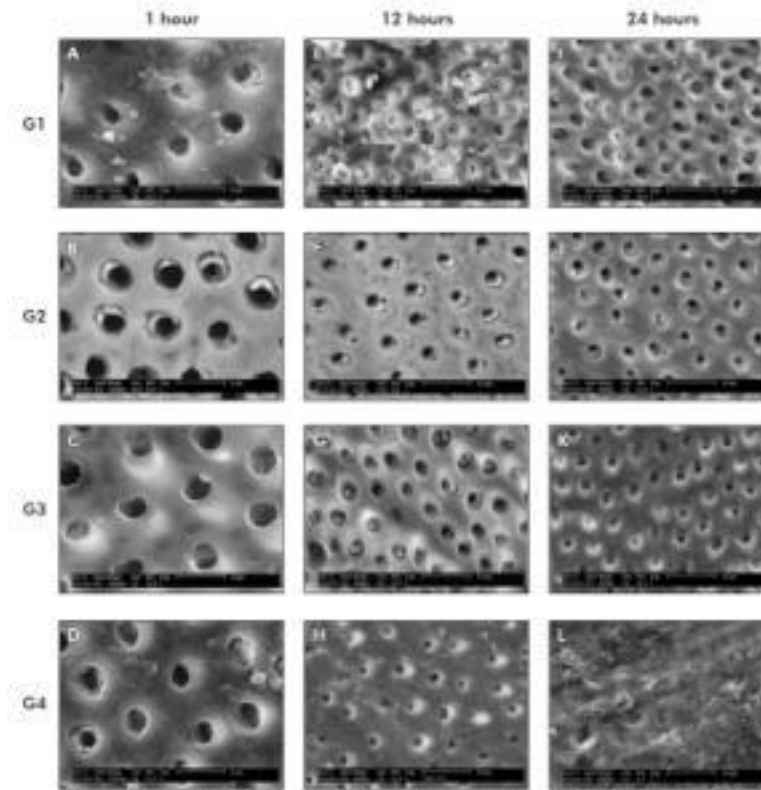


Figure 1 - SEM micrographs of the test discs at different durations of immersion in artificial saliva. The images on the left, middle and right columns show dentin discs where the products were applied after 1, 12 and 24 hours of immersion in artificial saliva, respectively. The images from the top to the bottom row show dentin discs allocated in accordance with the experimental group: G1, G2, G3 and G4, respectively.

Restorative materials

- Glass ionomer, resin-reinforced glass ionomer/ compomers, adhesive resin primers and adhesive resin bonding systems have been used successfully for the treatment of dentine hypersensitivity.
- Treatment can be problematic if there has been little tissue loss and over contouring and inadequate margins can lead to plaque retentive sites and gingival inflammation.
- These materials can be abraded and may need reapplication on a routine base.

Bioglass

- Bioglass was developed to stimulate the formation of new bone. It has been used in dentistry to fill up the osseous defects during periodontal surgery.
- It has been reported that a formulation of bioglass can promote infiltration and remineralization of dentinal tubules.
- The basic component is silica, which acts as a nucleation site for precipitation of calcium and phosphate.
- SEM analysis has shown that bioglass application forms an apatite layer, which occludes the dentinal tubules.

Iontophoresis

- Was first used in the early 1960s to treat dentin hypersensitivity.
- Iontophoresis uses a low amperage direct electrical current to introduce ions or ionized drugs into tissues. This procedure allows a concentrated application of the drug in a desired localized area. By applying the appropriately charged electrical current, ionized drugs can be driven into tissue based on the principle that like charges repel and opposite charges attract.
- Treats through, the formation of reparative dentin following application of current to dentin, electrical current produces paresthesia by altering the sensory mechanism of pain conduction or causes micro precipitation of calcium fluoride that may block the tubules.



Laser

- Laser irradiation has been advocated for the alleviation of symptoms from dentine hypersensitivity.
- May cause coagulation and protein precipitation of the plasma in the dentinal fluid or by alter the nerve fiber activity.
- Another opinion is that the reduction in dentine hypersensitivity could be the result of alteration of the root dentinal surface by physically occluding the dentinal tubules

Periodontal surgery

- The periodontal procedures which can be carried out to cover exposed root surfaces like lateral pedicle grafts, free gingival grafts, connective tissue grafts, etc.
- However, recession coverage requires careful treatment planning and understanding of the defect to be treated.
- Though these procedures cover the exposed dentine, soft tissue grafting for management of sensitivity is not considered as a very predictable treatment strategy and would not be the first choice for treatment for dentine hypersensitivity due to being an invasive procedure and in terms of cost.

Pulpal sensitivity

- Root Canal Treatment Is one of the last choices in treating dentinal hypersensitivity

Patient Education

- Causes of dentinal hypersensitivity
- Instructions on tooth brushing 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
- Hypersensitivity associated with tooth whitening

Recommended actions for preventing dentine hypersensitivity (adapted from Drisko, 2002)

Suggestions for patients

- Avoid using large amounts of dentifrice or reapplying it during brushing
- Avoid medium- or hard-bristle toothbrushes
- Avoid brushing teeth immediately after ingesting acidic foods
- Avoid brushing teeth with excessive pressure or for an extended period of time
- Avoid excessive flossing or improper use of other interproximal cleaning devices
- Avoid “picking” or scratching at the gumline or using toothpicks inappropriately

Suggestions for dental professionals

- Avoid over-instrumenting the root surfaces during scaling and root planing, particularly in the cervical area of the tooth
- Avoid over-polishing exposed dentine during stain removal
- Avoid violating the biological width during restoration placement, as this may cause recession
- Avoid burning the gingival tissues during in-office bleaching, and advise patients to be careful when using home bleaching products

Thank you