

Dentine hypersensitivity (DH)

It is the tendency of teeth to react painfully to stimuli. Acute sharp pain of short duration arises from exposed dentine and is a common finding in the adult population and have been reported to affect an many as 1 in 7 patients attending to dental clinic

- Clinical studies and questionnaire on DH indicate a prevalence of 4-74%
- It is mostly affects individuals at the end of their third decade of life, causing great discomfort
- It is experienced by women at a younger age than men
- It is mostly found in permanent canines and premolars in both dental arches
- The cervical region of the vestibular face of teeth is the most affected region
- The stimulus that triggers the onset of pain can be thermal, chemical or mechanical origin
- The most common complaint is caused by cold stimuli
- Pain may also occur by chemical stimuli such as acidic food, sweets and rarely by salty foods
- Mechanical stimulus frequently occurs when the patient rubs the sensitive area with a finger nail or tooth brush bristles during brushing, setting of pain
- The atmospheric air during mouth breathing, particularly in winter, which is associated with cold or the air of a triple syringe by dehydration also causes pain

The causes of exposure of dentine can be summarise as following:

- 1- Either removal of enamel covering the crown of the tooth
- 2- Or denudation of the root surface by loss of cementum and overlying periodontal tissues

Enamel loss may result from:

- a. **Attrition** relating to occlusal abnormalities. Attrition is defined as the wearing of the teeth surfaces due to normal or abnormal function
- b. **Tooth brush abrasion** which is wearing of the teeth substance through an abnormal mechanical process as incorrect brushing which leave a deep V- shaped cervical lesion
- c. Dietary reason which is a mechanical process (as acids) manifested as a localized progressive destruction of enamel and dentine
 - The defects vary in shape from exposure to non bacterial acids in the diet, chemical products, medication, drugs or endogenous acids from reflux or regurgitation of stomach acid; that is substances with low pH lead to the loss of dental structure by chemical dissolution without bacterial involvement



Difference between dental attrition, abfraction, erosion and abrasion



Attrition



Abfraction



Erosion



Abrasion

- This process produces a more softened enamel zone.
- In the cervical area, the thinner enamel can be gradually dissolved and dentin becomes exposed to the oral environment
- The acid environment can also open the dentinal tubules even further, leading to a greater sensitivity

d. Habits as grasping things between teeth

Cementum loss could be due to

a. Gingival recession which increase in severity with advancing age

Gingival recession may be due to

- **Mechanical trauma:** hard brush, vigorous technique
- **Predisposing anatomic factors** such as: thin gingiva, prominent roots, dehiscences, fenestrations, frenum pulls
- **Roots moved outside alveolar housing** by orthodontic appliances
- Crown o restoration margins
- Periodontal disease
- Occlusal trauma
- Trauma from teeth in opposing jaw
- Oral habits
- Poorly designed partial denture
- Tooth position
- Healing response following periodontal surgery



b. Chronic periodontal disease as the root surface may become exposed as part of the disease process and the overlaying cementum layer is thin and can easily to be removed

c. Following periodontal therapy as scaling and root planning and periodontal surgery

- Scaling and root planning may lead to removal of a thin cementum layer during periodontal scraping and expose the dentinal tubules which induce the hypersensitivity which is most likely transient and may disappear within few weeks (it reaches the peak in the first week after treatment)

d. Physiological causes: the increase in the number of teeth with root exposure is evident, as age advances

- Tooth extrusion in case of absence of an antagonist tooth, results in root exposure, which may lead to DH
- **The main symptoms of DH** are sharp pain of rapid onset and short duration provoked by different stimuli and usually resolves immediately after withdrawal of the stimulus
- Dental caries with pulpal changes have the same symptoms but in the absence of other dental pathology, these symptoms refers to **DH**

Theories of sensitivity

Many theories have been used to explain the mechanisms of DH. An early hypothesis was **1. dentinal receptor mechanism theory**, which suggests that DH is caused by the direct stimulation of sensory nerve endings in dentine

- On the basis of microscopic and experimental data, it seems unlikely that neural cells exist in the sensory part of the outer dentine. So this theory is not well accepted

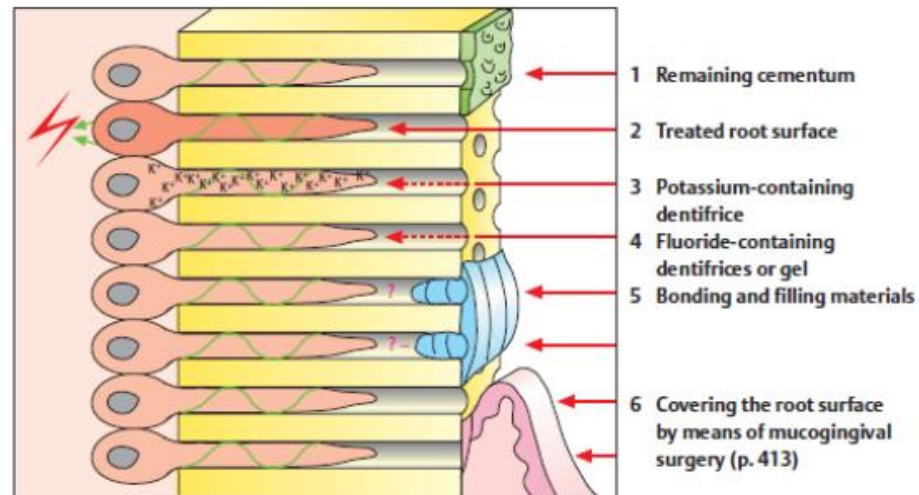
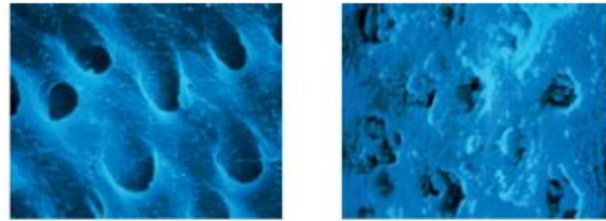
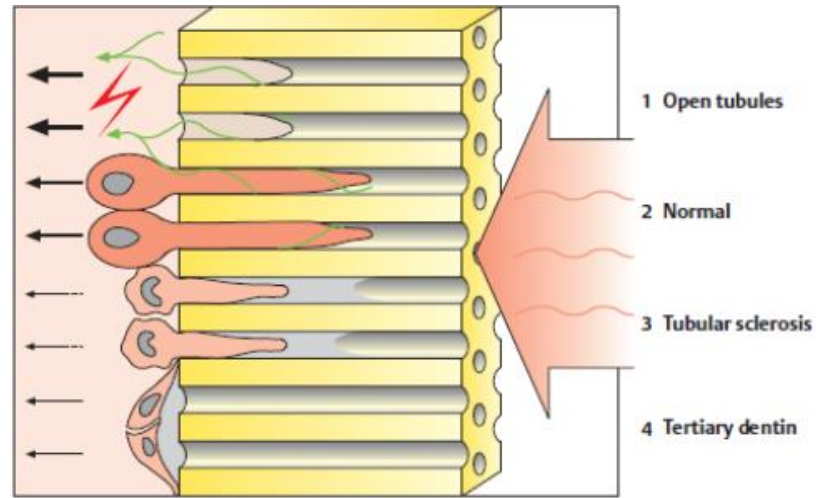
2. The odontoblast transducer mechanism proposed that odontoblasts act as receptor cells, mediating changes in the membrane potential of the odontoblasts via synaptic junctions with nerves

- This could result in the sensation of pain from the nerve endings located in the pulpodentinal border; however, evidence for the odontoblast transducer mechanism theory is generally lacking and inconclusive

Pain, caused by the fluid movement in the dentinal tubules, can be explained by the widely accepted

3. Hydrodynamic theory

- According to this theory, the transmission of stimuli to the pulp occur with a rapid movement of fluid within the dentinal tubules (normally there will be slow outward fluid flow).
- So there will be sudden shift of the dentinal tubular content which will stimulate pain receptors when a stimulus applied on exposed dentinal tubules



Diagnosis and clinical management of DH

Clinical management of DH is based on a proper diagnosis, considering its severity, localised or generalised condition, elimination of other possible causes of pain, elimination or prevention the causes

- This may involve patient counselling about oral hygiene practice (type and hardness of toothbrush, brushing before or after meals), diet (frequency of food and acidic beverage intake) and other harmful habits
- A correct history from the patient associated with a careful clinical and radiographic examination allows DH to be differentiated from other pathologies that affect the teeth

Differential diagnosis

Odontogenic origin

Cracked tooth syndrome, Fractured restoration, chipped teeth, dental caries, periodontal disease, post-restorative sensitivity, marginal leakage, pulpitis, palato-gingival groove and bleaching sensitivity

Non- odontogenic origin

Mucoskeletal, neuropathic, inflammatory (sinusitis), neurovascular, systemic (cardiac, herpes zoster, sickle cell anaemia, neoplasm), psychogenic, referred pain

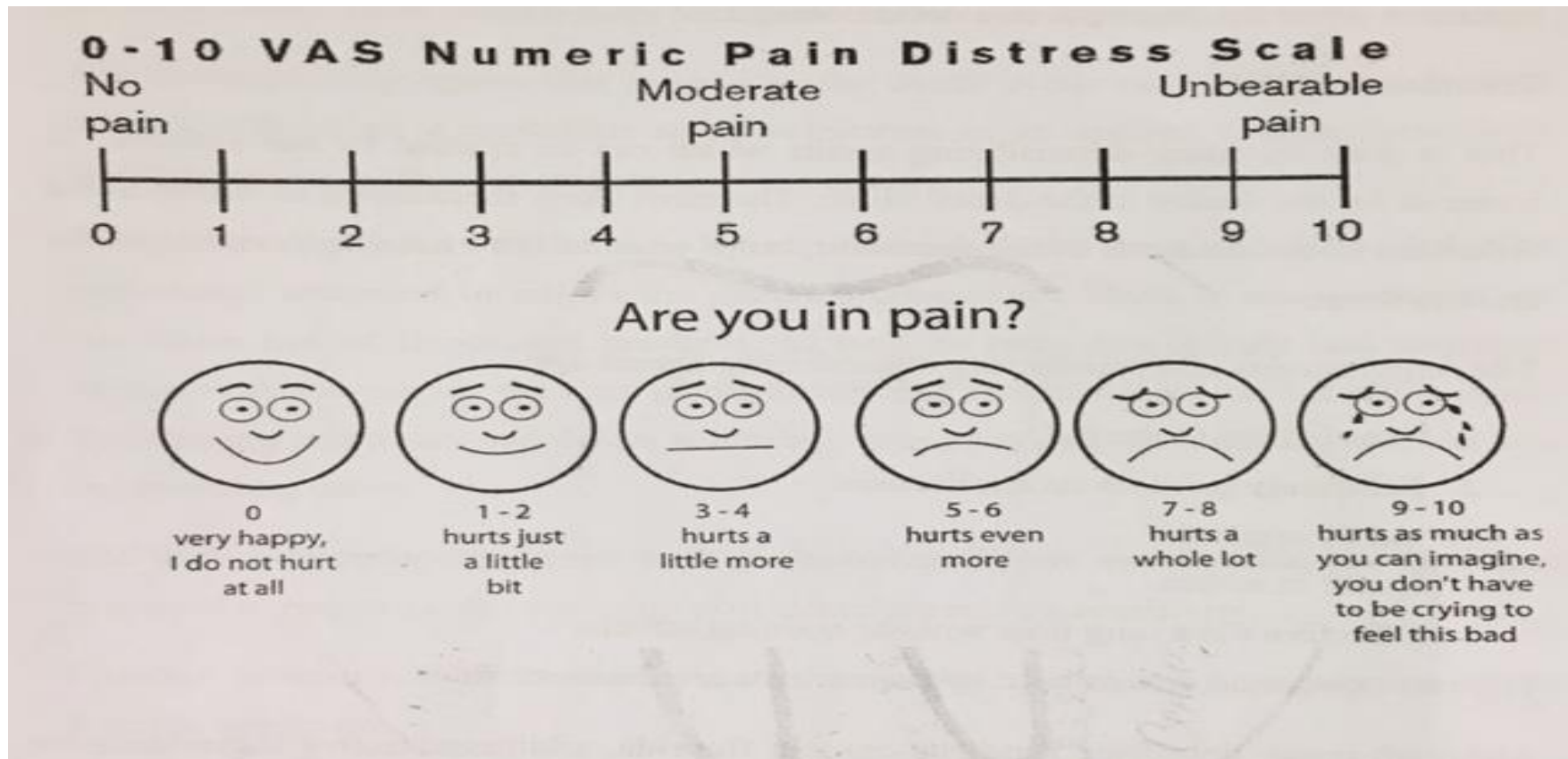
- Taking these factors into consideration, it is necessary to exclude other forms of pain or dental sensitivity
- To obtain a conclusive diagnosis of DH, first carefully evaluate, investigate and compare among the other teeth, in order to eliminate other possible causes of pain which could lead to confusion
- A good clinical history is essential and questions asked by the professional may help to collect important information that will assist in the treatment

Traditionally, dentist used to use an exploratory probe or jets of air from a triple syringe on the exposed surface or provoke a response from the patient

- Tactile stimulus with the use of a probe is the easiest, fastest and most precise method identify the areas suspected of having DH

The method consists of touching the cervically exposed dentine with a probe starting from the distal and passing towards the mesial region, examining all the teeth in the area in which the patient reports pain

- The degree of severity of pain can be quantified by means of a descriptive scale:
Slight, moderate or intensive pain or a visual analogue scale- VAS from 0-10



- Spontaneous cure occur by the natural remineralisation process in the mouth, which promotes natural tubular occlusion of dentine and pain may return because of the smear layer removal by food and acidic drinks thus explaining the cyclic characteristic of DH

- After observing the severity and number of teeth involved, an active approach to DH can begin in the cases of generalised DH, by a home method followed by in-office treatment when the first option is not successful

Treatment of DH

This can be done by using desensitising agents which can be applied by the patients at home or by dentist in the dental clinic

- The most likely mechanism of action is the reduction in the diameter of the dentinal tubules so as to limit the displacement of the fluid in them

Requirements of a satisfactory desensitising agents are

1. Non-irritant to the pulp
2. Relatively painless on application
3. Easily applied
4. Rapid in action
5. Effective for long time without staining effects

The most common agents used by the patients are dentifrices

- Although many dentifrices products contain fluoride, additional active ingredients for desensitization are added as strontium chloride, potassium nitrate and sodium citrate
- An example of the dentifrices is Sensodyne which contain strontium chloride
- Other example is Emaform in which the active ingredient is formaldehyde in addition to Lacalut extrasensitive
- Also the fluoride rinsing solutions and gels can also be used after usual plaque control procedures



Mode of action

- Desensitising agents act by the precipitation of crystalline salts on the dentine surface which block dentinal tubules
- Patients must be aware that their use will not prove to be effective unless using it continuously for a period of at least 2 weeks
- The desensitising agents that is used in the dental clinic act by blocking dentinal tubules with either a crystalline salt precipitation or an applied coating (varnish or bonding agent) on the root surface

- Topical application of fluoride by a professional has been recommended after periodontal treatment in case of severe pain to relieve the patient's discomfort
- There is also evidence that the home use of fluoride products, as well as potassium nitrate, strontium acetate with fluoride, in the form of **dentifrices** and **mouthwashes** can benefit patients by reducing sensitivity and dentin solubility, acting not only in reducing DH, but also in preventing caries

- The use of desensitising agents such as potassium nitrate and fluoride has also been proposed to reduce tooth sensitivity post-dental bleaching
- Fluoride solutions and pastes have been the agents of choice, examples of the fluoride agents are:
 - 1- Sodium fluoride paste ---33% of this paste is found effective in relieving hypersensitivity
 - 2- Stannous fluoride (unstable solution, it has to be prepared freshly

It has been found that the aqueous solution of stannous fluoride in low concentration will be effective in controlling DH

- It is applied for 2 minutes, and about an hour after application, the patient should not eat or drink

Other desensitising agents are

- Sodium mono-fluorophosphate
- Calcium hydroxide
- Potassium oxalates
- Resin and adhesives. Etc

Recently, attempts have been made to improve the success of these treatments by using lasers. **Laser therapy** has been recommended to treat DH with effectiveness between 5.2% and 100%, depending on the type of laser and parameters used

- According to authors, lasers are more effective than other treatment, although the effectiveness diminishes in severe DH
- In severe cases where any other type of treatment is not useful so root canal treatment could be the last choice

Root dentine hypersensitivity

Patients subjected to scaling and root planning in periodontal therapy may experience increased sensitivity after instrumentation procedure of treated teeth to evaporate, tactile, thermal and osmotic stimuli

- Usually, the symptoms develop and occur during the first week after treatment and to subside or disappear within the subsequent weeks
- However, occasionally the condition may become a chronic pain problem and may persist for months or years
- In a comprehensive questionnaire survey, severe painful symptoms were reported to prevail in 26% of the subjects 6 months to 5 years after the completion of treatment, while 16% of non surgical treated cases had pain symptoms
- In a clinical trial comprising 35 patients, observer that the majority of patients subjected to non-surgical periodontal instrumentation developed sensitive teeth, while only a few teeth in a small number of patients developed highly sensitive root surfaces

The main initial symptom is the **sharp pain of rapid onset** that **disappears once the stimulus is removed**

- In more severe, long-standing cases shorter or longer periods of lingering, dull or aching pain symptoms may be provoked
- Even a minimal contact of a toothbrush with the root dentin surface may result in intense pain, a condition which may not only uncomfortable but could likely to hinder proper oral hygiene measures

- The fact that the root surfaces become sensitive to a variety of external derived stimuli after periodontal instrumentation is not surprising as **dentinal tubules become uncovered** to the oral environment and subject to hydrodynamic forces
- Hence, a variety of pain evoking stimuli including evaporating, tactile, thermal and osmotic stimuli may elicit sudden fluid shifts in the exposed tubules ,thereby inducing a painful sensation according to the hydrodynamic theory of dentine hypersensitivity
- This mechanism alone can certainly explain the sensitivity that patients experience immediately after the instrumentation procedure and during a short period afterwards
- Whereas, it does not explain why the symptoms increase over time and why the pain condition may prevail in certain patients and certain teeth

The increase in pain intensity may have one or both of the following two explanations:

1- Firstly, the smear layer formed on the root surface by scaling procedure will be dissolved within a few days. This in turn will increase the hydraulic conduction of the involved dentinal tubule and thus decrease the peripheral resistance to fluid flow across dentine. Thereby pain sensations are more readily evoked

2- Secondly, open dentinal tubules serve as pathways for diffusive transport of bacterial elements in the oral cavity to the pulp, which is likely to cause a localised inflammatory pulpal response

Note: an important factor for reducing or eliminating hypersensitivity is adequate plaque control. However, hypersensitivity may prevent plaque control, therefore, treatment of hypersensitivity in addition to plaque control measures are very important

- Plaque control is a pivotal integral part of the prevention and treatment of root DH.
- It has been clinically observed with time that teeth in patients with excellent oral hygiene habits develop hard, smooth and insensitive root surfaces
- However, when severe symptoms of root hypersensitivity has emerged, it is difficult to motivate the patient to maintain the degree of plaque control that is necessary to allow for a natural occlusion of the dentinal tubules
- In such situations, an agent may be beneficial which has a reasonable capacity to block the open tubule, at least temporarily, so that proper oral hygiene measure can be reinforced
- In severe cases, where no remedy is achieved with any advice or treatment approach, pulpectomy and root canal treatment may be the choice