Dentine Hypersensitivity – A new vision on an old problem

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Introduction

Dental hypersensitivity may be defined as pain arising from exposed dentine, typically in response to tactile, thermal, chemical, or osmotic stimuli that can not be explained as arising form any other form of dental defect or pathology. Numerous desensitising agents have been tried and used in the history of dentistry to alleviate the pain from hypersensitive dentine.

There are various desensitizing agents and techniques used for the treatment of dentinal hypersensitivity. The mode of delivery of these desensitizing agents on to the tooth surfaces can be in various forms such as dentifrices, gel, varnishes, tooth mousse, and solutions which taken longer time to act and reduce the hyper sensitivity only after multiple applications. Hence, search of medicament or the technique which can give an immediate and long lasting relief is necessary.

What is dentin hypersensitivity?

Dentin hypersensitivity is often described as "short, sharp pain arising from exposed dentin in response to stimuli, typically thermal, evaporative, tactile, osmotic, or chemical and which cannot be ascribed to any other form of dental defect or pathology."[1]

Ruling out other possible causes of tooth pain is essential before making a diagnosis of dentine hypersensitivity. The short, sharp pain of hypersensitivity generally disappears when the stimulus is removed and can be differentiated from the other sources of pain described as severe, intermittent, throbbing, and elicited by chewing, or occurring without provocation. A thorough assessment of symptoms and clinical findings assisted by diagnostic aids and tests can, by ruling out the presence of other conditions, confirm a diagnosis of hypersensitivity.

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Aetiology & pathology of dentin hypersensitivity: [1]

Except for sensitivity associated with tooth bleaching or other tooth pathology, the cause of dentin hypersensitivity is exposed dentinal tubules as a result of gingival recession and subsequent loss of cementum on root surfaces. The dentinal tubules contain the protoplasmic projections of cells called odontoblasts within the pulp chamber. These cells contain nerve endings and when disturbed, depolarize giving neural discharge which is interrupted as pain. The pain has a rapid onset and is usually of short duration, but it can persist as a dull ache. The most widely accepted theory of how pain occurs is "Brannstrom's hydrodynamic theory of dentine hypersensitivity" which postulates that pain results from indirect neural stimulation caused by dentinal fluid movement in odontoblast.

Which teeth are affected?

Most oral health professionals know intuitively which teeth are most often sensitive. Canine and first premolar seems to exhibit sensitivity most frequently, followed by incisors, second premolars, and then by molar teeth.[2,3] The area most often affected is the buccal aspect of the tooth.4 Recession is primarily a buccal phenomenon since brushing is usually more vigorous at bucco – gingival surfaces.5 Recession, hypersensitivity and tooth brushing are linked, although the relationship is still not clearly established.

Requirement for an ideal desensitizing agent

Grossman (1935)6 suggested the following requirements for an ideal desensitizing agent or technique: 1) it should be non irritant to the pulp, 2) relatively painless on application, 3) easily applied, 4) rapid in action, 5) effective for a long period, 6) without staining effects and 7) consistently effective.

Management of dentine hypersensitivity:

Therapies employed to relieve this condition have been classified into: a) anti-inflammatory drugs like corticosteroids, b) protein precipitant – formaldehyde (formalin), silver nitrate and strontium chloride hexahydrate, c) tubular occluding agents like aluminium lactate, brushing with sodium fluoride, kaolin and glycerine paste, ferric and aluminium oxalate, fluoride iontophoresis, sodium monofluorophosphate, stannus fluoride, nicomethanol hydrochloride, potassium nitrate, potassium chloride and potassium oxalate, cyanoacrylate, d) tubular sealants e.g. Resins and adhesive bonds and e) miscellaneous like lasers, prosthodontic rehabilitation etc.

After making proper diagnosis of hypersensitivity the following treatment options can be tried –

1. home care
2. professional care
3. Combination of 1 &2
4. Home care:

Home care procedure should be emphasised as a primary factor when initiating treatment of sensitivity. Discuss diet with the patient if necessary to eliminate foods that are acidic or sour and fermentable carbohydrate which can produce acids in plaque. Gedelia et al. (1978) indicated tooth sensitivity can improve with a change in oral hygiene procedures.
A number of desensitising tooth paste, tooth mousse or cream and oral rinses are available.

Tooth pastes are made of 5% potassium nitrate, 10% strontium chloride & sodium nitrate or multi ingredient tooth paste made up of by a combination of more than two components. They are used twice daily. (Fig. 1)

FIG 1: DESENSITISING TOOTH PASTE & TOOTH MOUSSE

Tooth Mousse is water based, sugar free cream containing Recaldent, CPP-ACP (Casein phosphopeptide – Amorphous Calcium Phosphate). When CPP-ACP is applied to the tooth surface for 15 days, it exerts a rapid desensitizing effect on the teeth. (Fig. 1)

Mouth rinses are sodium fluoride based, available in two concentrations.
0.2% NaF(900ppm) are usually recommended for 1 or 2 times weekly while 0.5%NaF(220-250ppm) rinses are recommended for use 1 or 2 times daily. (Fig. 2)

FIG 2: DESENSITISING ORAL RINSES

Professional Methods & Products:

Initial preparation of teeth must be done before any desensitising agent is professionally applied. Teeth must be free of hard and soft deposits, dried and isolated prior to treatment.

Formalin (40%): It is claimed to precipitate albumin or denature tome?s fibres. A cotton pellet is rubbed into the sensitive area. A Porte polisher is used to continue rubbing for a defined time period. The agent should not touch the mucosa, since a reaction (precipitation of protein with the tissues) will occur resulting in soft tissue irritation.

Silver nitrate: It is a powerful protein precipitant and denatures Tome?s fibres. This solution is applied directly to the sensitive area alone or in combination with formaline/eugenol with the precipitation of elemental silver. However, silver salts can diffuse trough the dentine and pulp leading to minor pulpal inflammation and tooth discoloration.

Potassium nitrate: It desensitises the nerve. The potassium nitrate molecule penetrates through the dentinal tubule to the nerve and then depolarizes, thereby, preventing it from sending pain signals to the brain.7

Solution of 40% zinc chloride and 20% potassium

ferrocynide: They are used in a two step process resulting in protein precipitation and desensitisation of Tomes fibres.

Method of application: The solution of zinc chloride is applied with moist cotton pellets or Porte polisher with the use of unwaxed floss or tape. Zinc chloride is rubbed vigorously on the interproximal surfaces and allowed to remain on the tooth for one minute excess solution is removed from the gingival margin while the tooth is still moist. The second solution of potassium ferrocynide is applied. This solution is rubbed vigorously until a white precipitate forms. Again dental floss is worked interproximaly. One minute is allowed for the reaction to occur and then the excess is removed from the gingival margin.

Fluoride gels and solution: The teeth should be scaled and stains removed prior to fluoride treatment. If a specific tooth is sensitive fluoride can be burnished into the area with a Porte polisher.

1) Sodium silico fluoride: Saturated solution containing 0.7% in cold water. The preparation is rubbed into sensitive areas for 5 minutes. A calcium gel is formed and stated to be improved insulating barrier. 8, 9

2)Stannous fluoride: containing 8.9% stannous ion is used, during prophylaxis the paste is being rubbed into sensitive areas preferably with a Porte polisher.
In all fluoride treatment the suggested regimen is to apply the material at weekly intervals at least three times to obtain optimum results.10

Multi-Ingredient toothpaste: New desensitising toothpaste is available that contains the following ingredients-
a) 5%Poassium nitrate
b) 0.7%Sodium monoflourophosphate
c) 0.3%Triclosan

Potassium nitrate works on the principle of Nerve Desensitization. It is the only product approved by ADA and FDA. It is theorized that potassium nitrate penetrate through the dentinal tubules to depolarize the nerve and prevents it from repolarizing, thereby, preventing it from sending pain signals to the brain.

Sodium monoflourophosphate acts by occluding open tubules and thus preventing the fluid shift in the dentinal tubules and thus reducing sensitivity.
Triclosan (2, 4, 4-trichloro-2-hydroxydiphenylether) is a broad spectrum non-ionic antimicrobial agent which is effective against most types of oral cavity bacteria. Thus triclosan inhibits plaque formation thereby maintaining oral hygiene.

Tooth mousse or cream: It was introduced in 2002. It has quickly become a favourite with the dental professionals as a topical coating for the teeth. It reduces the sensitivity remarkably. It is available in different flavours.
Tooth Mousse is water based, sugar free cream containing Recaldent, CPP-ACP (Casein phosphopeptide – Amorphous Calcium Phosphate). When CPP-ACP is applied to the tooth surface, it binds to bio films, plaque, bacteria, hydroxyapatite and surrounding soft tissue localizing bio available calcium and phosphate. Saliva enhances the effectiveness of CPP-ACP and the flavour helps stimulate salivary flow.
Tooth mousse exerts a rapid desensitizing effect through immediate protein binding followed by deposition of calcium and phosphate compounds within the exposed tubules.
Method of application:
1)Remove excess saliva on the surface with a cotton pellet.
2)Apply a generous layer of Tooth Mousse to the tooth surfaces with an applicator swab or gloved finger. In difficult interproximal places, use an interproximal tooth cleaning brush.
3)Leave it undisturbed for 3 minutes. Avoid expectoration or swallowing.
4)Ask the patient to gently rinse after 3 minutes. Alternatively, it is safe to swallow the paste.
Total duration of treatment is two weeks.

Glucocorticoids: Steroid (prednisolone) was successful in reducing thermal sensitivity (Mosteller, 1962). Steroid application to dentine increases peritubular dentine mineralization; lumen would be

decreased resulting in less dentine tubule fluid movement (Mjor, 1967).

Resin impregnation: Fine particle hybrid resin composites or compomers are used.

Method of application -

Tooth is isolated..The area is dried with a continuous air spray for 20 seconds. Surrounding enamel is acid etch with 45% orthophosphoric acid for 45 seconds. The tooth is washed and dried. The dentine bonding agent is applied and light cure for 10 sec. which enters into the tubules through capillary and reactive forces. The hybrid composite resin is applied incrementally to close the defect and light cure until it hardens (40 sec). (Fig. 3)

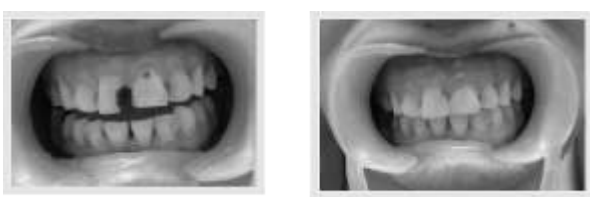


FIG 3: HYPERSENSITIVITY TREATED WITH LIGHT CURE

Mouthguards

The use of a mouthguard type appliance to deliver potassium nitrate desensitising agent was first reported by Reinhart et al. in1990.11 A vacuum formed mouthguard appliance is made and the patient is instructed to place small amount of a desensitizing dentifrice containing 5% potassium nitrate, casein derived products or fluorides. These treatments are usually done overnight for six weeks. No controlled clinical trials have been done to confirm the efficacy of this technique. (Fig 4).

FIG 4: MOUTHGUARDS

Iontophoresis

The in office use of iontophoresis of sodium fluoride to treat hypersensitive dentine has been advocated by Gangarosa (1983, 1994)12 and others (kerns et al. 1989, Christiansen 1998). It is a technique sensitive method that requires the purchase of an apparatus. Reports of lack of efficacy (Brough et al. 1985)13 may be due to inadvertent passage of current through adjacent gingival tissue rather than through cervical dentine. However, clinicians skilled in iontophoresis are strong advocates of its use for this purpose.

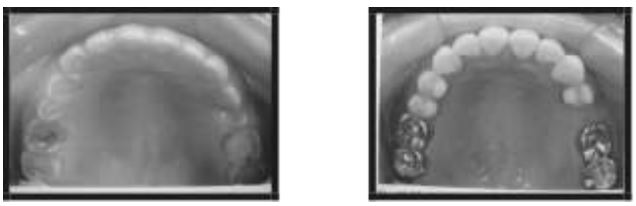
Lasers

Studies are very less using laser for treatment of sensitive dentine.14 Nd:YAG laser was used to treat the patients with cervical sensitivity to cold air. Laser treatment was done on exposed roots for 2 min at 10 pulses at increasing power levels until the patient detected the laser energy or until a maximum of 100 mJ was reached. Treated teeth were found less sensitive after laser treatment. The clinical results obtained in the use of lasers to treat hypersensitive dentine do not seem to justify their very high purchase price. It is extremely difficult to treat irregularly shaped cervical regions using a hand held light- guide, especially if the laser operates in a pulsing mode. (Fig 5)

FIG 5: LASERS

Hypersensitivity treated with All Ceramic Crowns

Prosthodontic rehabilitation: It depends upon the severity of tooth structure loss. If the vertical dimension of occlusion is not disturbed, the line of treatment for anterior teeth should be all porcelain or metal fused to porcelain full veneer crowns, for posterior teeth it should be all metal or porcelain fused to metal crowns. In case of loss of vertical dimension than treated the patient for full mouth rehabilitation by fixed prosthesis. (Fig 6)



Hypersensitivity treated with Full mouth rehabilitation
FIG 6: PROSTHODONTIC REHABILITATION

Conclusion

The ideal desensitizing agent is yet not known. Study results are variable and certain agents work best in certain circumstances and with certain individuals. The use of restorative materials is more effective than the use of topical agents. Consequently, clinicians must use a systemic trial and error approach based on the available evidence and professional experience. It is often necessary to use a hierarchy of products in succession until the most beneficial is identified. The strong placebo effect suggests that the combination of management strategy, treatment agents, and positive reinforcement can create a successful outcome, regardless of whether an ideal strategy or agent is utilized.

References:

1.Addy M. Etiology and clinical implications of dentine hypersensitivity. Dent Clin North Am 1990 34:503-14.
2.Addy M. Dentine hypersensitivity: New perspectives on an old problem. Int Dent J 2002: 20: 272-76.
3.Ficher C, FicherRG, Wennberg A. Prevalence and distribution of cervical dentine hypersensitivity in a population in Rio de Janeiro, Brazil. J Dent. 1992;20:272-76
4.Bissada NF. Symptomatology and clinical features of hypersensitive teeth. Arch Oral Biol; 1994; 39:315S-332S.
5.Addy M, Mostafa P, Newcombe RG. Dentine hypersensitivity: the distribution of recession, sensitivity and plaque. J Dent.1987; 15:242-248.
6.Grossman LI. A systemic method for the treatment of hypersensitive dentine. J Am Dent Asso. 1935. 22:592.
7.kanapa JA. Current treatment for dentinal hypersensitiviyty: A new agent. Compend Contin Educ Dent 1982; (suppl 3):S118-20.
8.Hoyt WH, Bibby BG. Use of sodium fluoride for desensitizing dentine, J Am Dent Asso 1943, 30:1372-76.
9.Minokov B., Marmari I., The effectiveness of sodium fluoride treatment with and without iontophoresis on reduction of hypersensitive dentinal pain. J Periodontal 1975: 46:246-49.
10.Tharsh WJ, Jones DL, DoddsWJ. Effect of a fluoride solution on dentinal hypersensitivity. Am J Dent 1992; 5:299-302.
11.Reinhart TC, Killoy WJ, Love J et al. The effectiveness of a patient - applied tooth desensitizing gel: a pilot study. J Clin Periodontol 1990;17:123-2.7
12.Orchardson R, Gangarosa LP, Holla et al. Dentine hypersensitivity into the 21st century. Arch Oral Biol. 1994; 39:113S-119S.
13.Brough KM, Anderson DM, Love J, Overman PR. The effectiveness of iontophoresis in reducing dentine hypersensitivity. J Am Dent Assoc.1985; 111:761-65.
14.Renton-Harper P, Midda M. Nd:YAG laser treatment of dentinal hypersensitivity. Br dent J 1992; 172:13-16.