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Management of Dentine Hypersensitivity

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Dentine Hypersensitivity in Hong Kong

Dentine hypersensitivity may be defined as short, sharp pain arising from exposed dentine typically in response to chemical, thermal or osmotic stimuli that cannot be explained as arising from any other forms of dental defect or pathology.[1] Dentine hypersensitivity is a common problem found in many adult populations. A study on 226 patients attending a dental hospital in Hong Kong in 2003 found about two third of the patients (68%) had dentine hypersensitivity.[2] The commonest initiating factor for dentine hypersensitivity among them was cold drinks. While many studies reported the commonest teeth affected are the premolars, the study found the commonest teeth affected were the lower incisors; and the majority of hypersensitive dentine surfaces were present on the facial surface of the teeth. The study also showed that dentine hypersensitivity peaked between 40 and 50 years of age, followed by a decline with age. The probable reason for this drop in dentine hypersensitivity after the fifth decade may be related to the pulpal changes with increasing age, particularly dentinal sclerosis and the laying down of secondary or tertiary dentine.

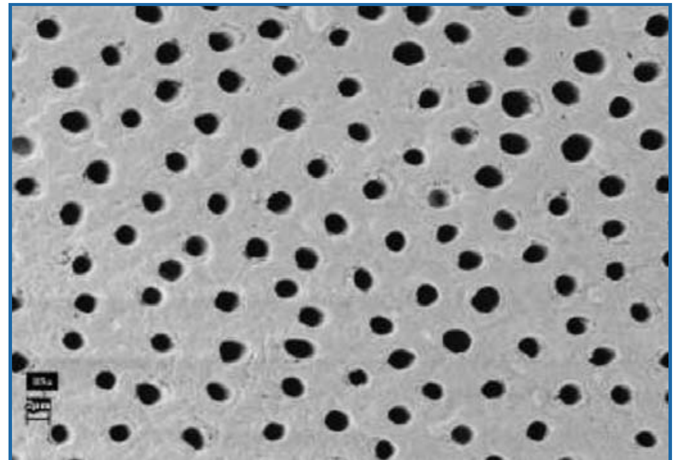
Figure 1 SEM Images of dentine surface (2000x)

Causes of Dentine Hypersensitivity

Dentine is generally covered by enamel in a tooth crown and by a protective layer called cementum in the tooth root. It contains many thousands of microscopic tubular structures that radiate outwards from the pulp (Figure 1); these dentinal tubules are typically 0.5-2 microns in diameter containing plasma-like biological fluid that is connected to the pulp. The cause of hypersensitivity is loss of enamel on the tooth crown (Figure 2) and gum recession exposing the tooth root (Figure 3). Enamel can be lost as a result of aggressive or incorrect tooth brushing, over consumption of acidic food and tooth grinding caused by stress and para-functional behaviours. A recent study in Hong Kong found many people frequently took fruits and lemon tea as their food and beverage (Figure 4).[3] The frequent intake of these can cause tooth erosion and dentine hypersensitivity. When the root of the tooth is exposed to the mouth due to gum recession, the cementum covering the tooth root can easily be removed and dentine is exposed resulting in dentine hypersensitivity. Gum recession may occur as a result of aggressive and incorrect tooth brushing, ageing, gum diseases and some dental operative and surgical procedures which lead the gum to move away from its normal position.

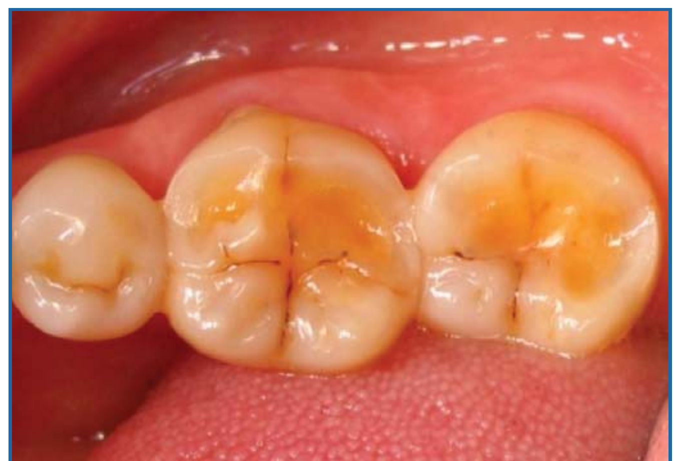
Figure 2 Enamel loss exposing dentine

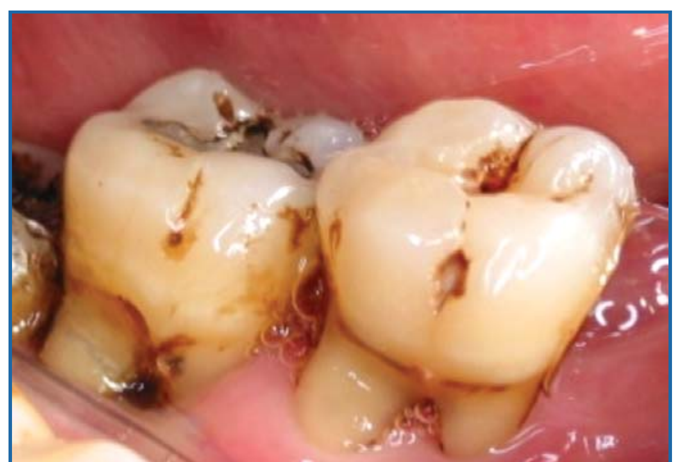
Figure 3 Gum loss exposing dentine

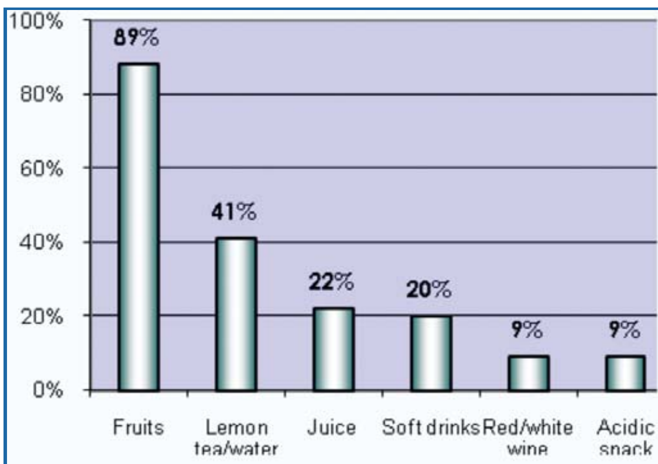

Figure 4 Common acidic food and beverages taken by Hong Kong people

The Hydrodynamic Theory of Dentine Hypersensitivity

The exact mechanism of dentine hypersensitivity is still under research. The hydrodynamic theory suggests that changes in the flow of the fluid present in the dentinal tubules can trigger receptors present on nerves located at the pulpal aspect thereby eliciting a pain response (Figure 5).[4] This hydrodynamic flow can be increased by changes in temperature, humidity, air pressure and osmotic pressure, or forces acting onto the tooth. Hot or cold food or drinks, and physical pressure are typical triggers in those individuals with dentine hypersensitivity.

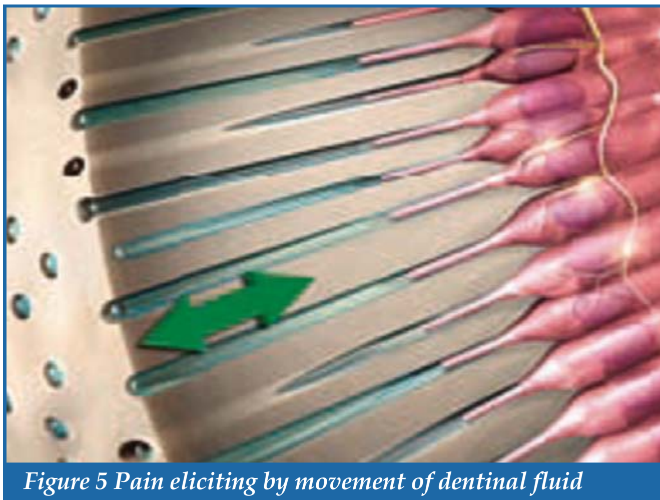

Figure 5 Pain eliciting by movement of dentinal fluid

Management of Dentine Hypersensitivity

It is essential to consult a dentist when a person suffers from pain with nature similar to the symptoms of dentine hypersensitivity. Dentinal hypersensitivity has all the criteria to be considered a true pain syndrome.[5] It may share similar symptoms with dental decay and gum disease. In addition, the cause of dentine hypersensitivity should be identified and a diagnosis by exclusion must be made for dentinal hypersensitivity, ruling out other conditions requiring different treatments. Once the diagnosis of dentine hypersensitivity is confirmed, the dentist often needs to discuss with his/her patient regarding his/her oral hygiene habits and diets. Changes and behaviour modifications such as decreasing the intake of acid-containing foods are often necessary to manage dentine hypersensitivity. The patient should also be shown correct brushing techniques because improper tooth brushing has often been associated with dentine hypersensitivity. It has been shown that both a manual and a power brush used with desensitising toothpaste are almost equivalent in effectiveness.[6]

Home Management with Desensitising Toothpaste

Use of desensitising toothpaste is considered by many as the "first option" recommendation. It is effective but often takes 4 to 8 weeks for pain relief. Two treatment approaches have been used to provide relief of dentine hypersensitivity. The first approach is to interrupt the neural response to pain stimuli (Figure 6); and the other is to occlude open tubules to block the hydrodynamic mechanism (Figure 7). Many desensitising toothpastes contain potassium salts, strontium salts and/or fluoride compounds. Potassium salts such as potassium nitrate and potassium citrate provide potassium ions to decrease the excitability of the nerves that transit pain sensation. Strontium salts such as strontium chloride and strontium acetate form mineralised deposits within the porous dentinal tubules and on the surface of the exposed dentine. Fluoride compounds such as sodium fluoride and silver diamine fluoride form precipitation of insoluble metal compounds, mainly calcium fluoride globules, which promote remineralisation and occlude dentinal openings on exposed dentine surface. Recently available desensitising toothpastes with new chemicals such as amorphous calcium phosphate and casein phosphopeptide-amorphous calcium phosphate (ACP-CPP) and arginine and calcium carbonate (Arginine-$CaCO_3$) are now available in the market. ACP-CPP and Arginine-$CaCO_3$ products have a similar mode of action to occlude and block open dentinal tubules from external stimuli associated with dentine hypersensitivity. Studies have used bioactive and biocompatible glasses which are known to induce osteogenesis in physiological systems, and hence could theoretically occlude tubules.[7] Toothpaste with calcium sodium phosphosilicate bioactive glass is also introduced. This bioactive glass material has been shown to seal and clog open dentinal tubules and thus reduces dentine hypersensitivity.[8]

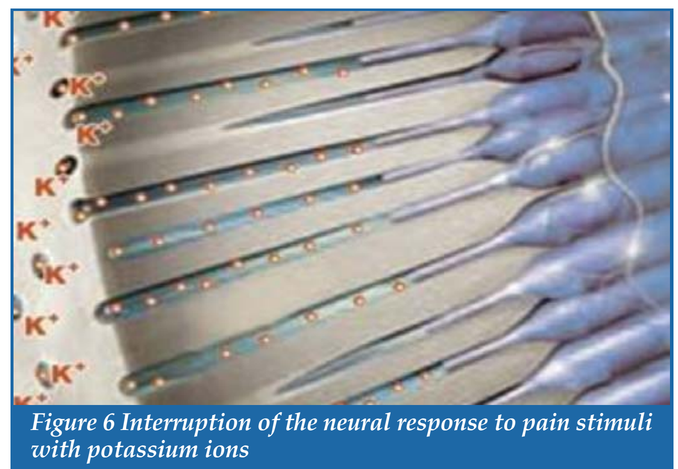

Figure 6 Interruption of the neural response to pain stimuli with potassium ions

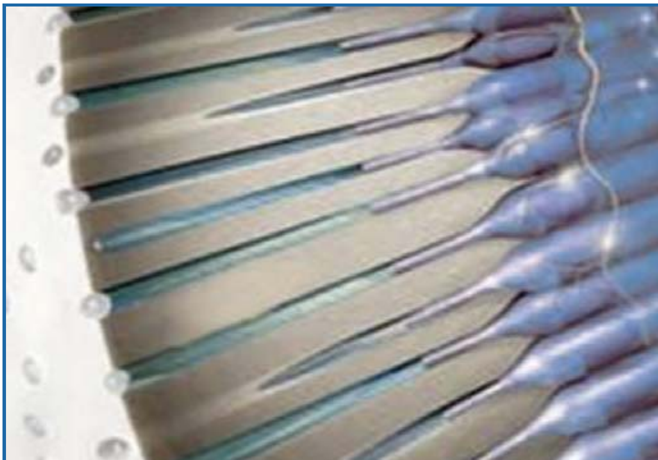
Figure 7 Occlusion of the open tubules to prevent pain stimuli

In Office Professional Care

Apart from desensitising toothpastes, dentist may apply a variety of professional medicaments to reduce the dentine hypersensitivity. A variety of products has been used to reduce dentine hypersensitivity, including resin-based materials, sodium fluoride varnish, oxalates or an aqueous solution of glutaraldehyde and hydroxyethylmethacrylate (HEMA). These products generally occlude and seal the dentine tubules. Arginine-$CaCO_3$ is also used as an active ingredient in a professionally used prophy-paste to manage dentine hypersensitivity. A clinical study on 390 patients found professional application of arginine and calcium carbonate by dentists and dental hygienists in Hong Kong significantly reduced severity of pain on patients with dentine hypersensitivity[9]. Furthermore, dentists may apply dental sealants and other desensitising and filling materials to cover the exposed dentine. Lasers can also be used to seal open dentine tubules, either alone or with surface treatments to manage dentine hypersensitivity.[10]

Conclusion

Dentine hypersensitivity is a common oral health problem among many adult population groups. Many treatment methods have been proposed and the choice varies according to the clinical presentation. When a patient presents with symptoms that may be attributed to dentine hypersensitivity, a thorough clinical examination should be carried out to rule out the other likely causes before making a diagnosis and embarking on treatment. Depending on the identified cause, a combination of individualised instructions on proper oral health behaviours, use of self-care products, and professional treatment may be required to manage the problem.

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