SENSITIVE TEETH

CAUSES & TREATMENT OPTIONS

TEETHMATE™ DESENSITIZER

The future is now… create hydroxyapatite

HAVING SENSITIVE TEETH IS A POPULATION-WIDE PROBLEM

And something every practice has to deal with

But what exactly do we mean by sensitive teeth? How many patients report to dental practices with this problem and is this figure in line with the prevalence? What are the different causes of sensitivity, and what treatment options are available? How effective are the various treatments and how long do they last? Is there a general protocol? Etc.

This reference booklet deals specifically with the causes and treatment options for sensitivity due to exposed dentin and provides answers to the above questions in the best possible way.

What is sensitivity?
Sensitivity is a common phenomenon in dentistry. Before treating a patient with sensitive teeth, it is necessary to know the cause of the sensitivity.

Having sensitive teeth is not only related to exposed dentin. Other causes include pulp infection and periapical inflammation, but also cracked tooth syndrome, leaking restorations, bonding and adaptation-related sensitivity, overburdening, periodontitis, trauma, and sensitivity due to bleaching.

Today, a new calcium phosphate-based material offers possibilities that will bring a change in the control of sensitivity due to exposed dentin.

The future is now...

SENSITIVITY CAN HAVE VARIOUS CAUSES, AND THERE ARE DIFFERENT TREATMENT OPTIONS

The conditions for dentin sensitivity are that the dentin must be exposed and the tubules must be open on both the oral and the pulpal sides. Patients suffering from dentin sensitivity describe the pain sensation as a severe, sharp, usually short-term pain in the tooth.
Holland et al.[1] characterise dentin sensitivity as a short, sharp pain resulting from exposed dentin in response to various stimuli. These stimuli are typically thermal, i.e. by evaporation, tactile, i.e. by osmosis or chemically, or not due to any other form of dental pathological defect. Patients with dentin sensitivity may react to air blown from the air-syringe or to scratching with a probe on the tooth surface. Of course, it is essential to rule out possible causes of the pain other than dentin sensitivity.

The causes of dental pain (as described in Endodontology by Thoden van Velzen and Wesselink[2]) are not limited to dentin sensitivity. For other causes of pain caused by

- excitation of pulp nerve fibres by electric current,
- pulpitis, in pulp extirpation,
- apical periodontitis,
- root canal treatment,

a treatment plan specially adapted to the cause in question will be used.

Other forms and causes of toothache include:

- cracked tooth syndrome,
- post-restorative sensitivity,
- fractured restorations,
- marginal leakage,
- trauma,
- sensitivity after bleaching,
- gingivitis

HYDRODYNAMIC THEORY

Over the years, different hypotheses have been put forward to explain dentin sensitivity. The most accepted explanation for the physiological cause is Brännström's hydrodynamic theory[3]. This theory states that when the dentin surface is stimulated, for example by cold, a fluid shift occurs in the tubules, which causes the nerve cells in the pulp to be activated and pain to be felt.

There are many treatment strategies and even more products that are used to eliminate dentin sensitivity. However, today there is unfortunately still no universally accepted treatment method. The many variables, the placebo effect, and the many treatment methods get in the way of the design of studies[4]. In most cases, the treatment of dentin sensitivity starts with the application of desensitizing toothpaste. After this or simultaneously, the treatment can be supplemented with one or more treatment options[5].

PREVALENCE

According to several publications[6 7 8 9 10], dentin sensitivity occurs in 3 to 98% of the population. This large bandwidth can be explained by the variety of selection criteria in the various studies but also the variety in the diagnostic approach.

Most patients with dentin sensitivity can be found in the age group of 30 to 40 years. However, erosion with dentin exposure occurs in more and more young adults, which often results in sensitivity. Older people are increasingly keeping their teeth for longer. In combination with the increased risk of periodontal disease and any subsequent treatment, more sensitivity problems are to be expected here as well.

Having dentin sensitivity is the most common form of toothache. However, many patients wait to report it to the dentist until the next check-up. Many do not even seek specialist help or treatment because they do not recognise dentin sensitivity as a significant dental health problem[11], even though it has been demonstrated that dentin sensitivity is related to a significantly reduced oral health-related quality of life[12 13].

CAUSES OF SENSITIVE TEETH

BOTH CLINICAL AND LABORATORY STUDIES SUGGEST THAT BUCCOCERVICAL ENAMEL IS LOST DUE TO A COMBINATION OF EROSION AND ABRASION.[15 16]

Although enamel is resistant to abrasion due to toothbrushing, it is sensitive to the effects of acid. Brushing enamel softened by acid action has a demonstrably abrasive effect[16]. Excessive brushing and do-it-yourself periodontal procedures and additional injuries can result in gingival recession and dentin exposure.
Acidic foods and gastric acid reflux contribute significantly to dentin erosion. Dababneh et al. quote a large number of studies on this in their review *Dentine hypersensitivity - an enigma*?[6]

SOME OF THE CAUSES ARE:

Toothbrushing
Incorrect brushing methods, excessive tooth brushing, whether electric or not, with a (too) hard toothbrush can lead to gingival recession and wedge-shaped defects.

Occlusion-related
Occlusion trauma, grinding, and clenching can cause problems. Wedge-shaped defects, known as abfraction lesions caused by bending forces during occlusion, also often cause problems.

Restorative
Cavity preparations and reshaping for both direct and indirect restorations expose up to a few million dentin tubules. Irritation of the nerve by a fluid shift in the tubules often causes sensitivity.

Orthodontic
As a result of orthodontic treatment, gingival recession can sometimes occur. Crowding is also a regular reason for gum recession, resulting in sensitivity.

Periodontic
In periodontitis, the gum recedes, exposing the root surface and increasing the risk of sensitivity.

Periodontal treatment
Sensitivity often occurs after extensive scaling, especially in subgingival tartar removal and root planing. Sensitivity also occurs regularly after periodontal surgery, in which root surfaces that were previously covered are exposed and in which the dentin tubules are no longer protected.

PREVENTION

Prevention of dentin sensitivity is undeniably crucial. Unexposed surfaces may be exposed sooner or later for many reasons. Painless exposed dentin surfaces may become painful.

UNCERTAINTY

The lack of confidence on the part of the practitioner when dealing with pain caused by dentin sensitivity is often the result of the lack of a clear, generally accepted treatment method. This is also due to the multitude of products with a variety of modes of action. In the Canadian Advisory Board report on Dentin Hypersensitivity from 2003, it concerned no less than half of the respondents[14].

DECISION TREE

The abovementioned CABDH report, which, according to L.C. Martens[5], is the best-developed report, presents a very useful algorithm (http://www.cda-adc.ca/jcda/vol-69/issue-4/221. pdf*) for the diagnosis and treatment of dentin sensitivity. However, the report does not look at having exposed cervical dentin without pain. It also does not look at having sensitive teeth without decreasing the patient's quality of life. There is also no hierarchy or priority list for treatment options[5]. A modified decision tree is presented in Martens' review. (www.ncbi.nlm.nih.gov/pmc/articles/ PMC3585983/?report=classic**) Part of the CABDH decision tree can be found on the "Technology" page.

LOCATION OF SENSITIVITY

Looking at the distribution of dentin sensitivity across the teeth, we see that the buccocervical zones are the most affected. On the spot, the enamel is thinner and gingival recession may occur soon.

The canines and first premolars are reported as being sensitive most frequently. These are followed by the incisors and second premolars. Dentin sensitivity is the least common in molars. It should be noted that this distribution cannot be maintained in, for example, periodontal patients.

It seems that dentin sensitivity has a negative correlation with plaque scores. Plaque scores on buccocervical surfaces of canines and premolars are often lower than on other buccal surfaces. The teeth in quadrants two and three score lower than those in quadrants one and four. There seems to be a relationship with brushing behaviour and technique and the higher number of right-handed people than left-handed people. A 1987 study by Addy et al.[17] showed that sensitive teeth have a very low plaque score. The data imply a role for toothbrushing with toothpaste in the localisation and perhaps even in the initiation of dentin sensitivity.

*CABDH algorithm

**Martens' review

TREATMENT OF SENSITIVE TEETH

THERE ARE DIFFERENT TREATMENT METHODS FOR SENSITIVE TEETH DUE TO EXPOSED DENTIN

Since Brännström's theory is generally accepted, it seems logical to base the therapy on this. In other words, blocking the fluid shift in the tubules. Several treatment methods are based on this. However, there are also products available that attempt to interrupt the neural activity by using potassium nitrate or potassium chloride.

EXAMPLES OF THIS ARE:

Toothpaste
Special toothpaste for sensitive teeth can contain different ingredients for sensitivity. Potassium nitrate inactivates the nerve endings. Strontium acetate is used to physically insert a plug into the tubules. Novamin, a bioactive glass-based product (Bioglass), can form a calcium phosphate layer in the presence of saliva and water, which then crystallises into hydroxyapatite.

Fluoride preparations
Fluoride preparations are used because they are believed to stabilise the biofilm. The preparation's composition also determines the extent to which the fluid shift in the tubules is counteracted. The formation of calcium and phosphate-based precipitates as well as calcium fluoride and fluorapatite is helpful in this respect.

Glutaraldehyde
Glutaraldehyde is a protein coagulation agent that prevents the fluid shift in the tubules.

Oxalates
Oxalic acid-based products obliterate the tubules by forming oxalate crystals locally. Again, the fluid shift is counteracted.

Synthetic resins
Preparations or 'regular' bondings developed specially to control sensitivity, but also synthetic resin-modified glass ionomers are used to seal the tooth surface and thus also the tubule entrances.

Laser
When using laser as a desensitizer, a distinction must be made between low-level and high-level therapy. Low-level therapy (soft-laser) attempts to inactivate the nerve endings around the odontoblasts. High-level therapy (hard-laser) generally aims to seal the tubules by fusing the dentin surface.

Calcium phosphate
Calcium phosphate-based products can form hydroxyapatite and seal the tubules. The tooth's own hydroxyapatite will bring about this sealing.

LIMITATIONS OF THE DIFFERENT TREATMENT METHODS

THE TEMPORARY NATURE OF THE RESULT IS REGARDED AS A GENERAL DISADVANTAGE[4,5].

Currently, no treatment method or combination of methods has been proven to be effective in the long term.

Toothpaste
In many cases, in particular when the sensitivity affects a larger number of teeth, the patient is initially advised to use a desensitizing toothpaste. The smear layer or precipitate formed by the toothpaste may quickly disappear, due among other things to the action of acids, which will totally or partially negate its effect. Depending on the abrasiveness of the toothpaste, it may also have an opposite effect. Many kinds of toothpaste, including those for sensitive teeth, have an RDA of 75 to 150. Or medium to highly abrasive. The hardness of the toothbrush used, the brushing time, and the brushing method also affect the intended sensitivity control.

Glutaraldehyde
Glutaraldehyde-based products are far from biocompatible. The effect is mostly temporary. Glutaraldehyde is a product proven to be toxic that is used for tissue fixation or as a disinfectant. There is an extensive list of adverse health effects of glutaraldehyde[18]. Contact with soft tissues should be avoided on account of toxicity. In one of his publications, Charles Cox perhaps rightly wonders whether glutaraldehyde, if it were to be offered to the FDA today, could be used as or in a medical device at all. The answer is undoubtedly no. It would never pass the “in vivo cell culture test”, according to Cox. The use of glutaraldehyde is still permitted by the FDA only on the basis of the so-called ‘Grandfather Clause’ from the 1940’s.

Oxalate types
Oxalate types are effective as desensitizers in the short term. They form a precipitate that is stable in an acidic environment. The stability is not very high in saliva. The precipitated salts dissolve (partly) or detach. The initial (low) acidity of the product has the additional disadvantage that at first the tubule entrances are widened before a precipitate is formed. After the disappearance of the crystals, the chance that the sensitivity will return even more strongly is not improbable.

Potassium nitrate
Potassium nitrate is a relatively harmless material to use. It reduces nerve activity. There is no evidence that the material is sufficiently effective as a desensitizer for sensitive dentin[19]. In fact, it ignores the generally accepted Brännström’s hydrodynamic theory[3].

Bonding / Synthetic resin
Adhesives that are used as desensitizers have the disadvantage that they turn the gingiva white when in contact with it. A reaction to the monomers and/ or solvents; this is usually temporary but obviously undesirable. Often the application of these materials requires rinsing, sometimes etching, and subsequent drying of the dentin surface. This is very annoying in sensitive dentin. The duration of action is usually very limited.[20]

Laser
When using lasers, we usually see short-term effectiveness with soft-laser. This is because the effect is analgesic and therefore limited in duration. In the case of hard-laser, if the energy level is (too) high, there is a risk that cracks will occur in the dentin, that the smear layer will be removed, and that organic matter will evaporate, resulting in an increased rather than a reduced permeability[4,21].

Calcium phosphate
Calcium phosphate has the disadvantage that the crystallisation into hydroxyapatite takes several hours. A recently developed process allows for a short curing time of a few minutes.

At present, there is too little evidence to indicate which method and which material is the most effective. The new calcium phosphate-based materials may change all this. An essential part of the treatment is, of course, the removal of the causative factors as much as possible.

THE REAL SOLUTION FOR SENSITIVE TEETH

TEETHMATE™ DESENSITIZER

Until now, the effective and long-lasting control of dentin sensitivity has been something of the future. With TEETHMATE™ DESENSITIZER, this will change today. The future is now…

TEETHMATE™ DESENSITIZER from Kuraray Noritake Dental is a desensitizer designed to provide an solution for tooth hypersensitivity. It effectively controls dentin sensitivity with a natural-based material. TEETHMATE™ DESENSITIZER crystallises after mixing into hydroxyapatite (HAp). This creates a hermetic and long-lasting seal. In addition, crystallisation takes place where it is most needed: in the tubules and the enamel microcracks.

The TEETHMATE™ DESENSITIZER powder is a mixture of two calcium phosphates, i.e. tetracalcium phosphate and anhydrous dicalcium phosphate. These are mixed with the liquid consisting of water and a newly developed reaction accelerator. The mixture will be rubbed with some pressure on/in the surface to be treated for 30 seconds. The water, part of the liquid, disappears from the mixture by absorption and evaporation. The water is 'only' a catalyst within the crystallisation reaction and, therefore, does not affect the final product. In fact, because the water disappears from and around the HAp crystals, the crystal lattice is compacted, which benefits the hardness. The final product is hydroxyapatite.

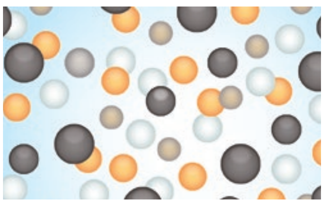
The surface to be treated only needs to be clean. It can remain slightly moist; there is no need for it to dry out. The patient will certainly appreciate that. TEETHMATE™ DESENSITIZER can be rubbed in with an application brush or another brush. For example, interdental application is easy with an interdental brush. For larger surfaces, use a soft cup-shaped polishing brush. After application, rinse off the excess with a soft jet of water.

The effect is immediate. However, the complete crystallisation into hydroxyapatite takes some time. It is recommended that the patient does not eat or drink for 45 minutes after the treatment.

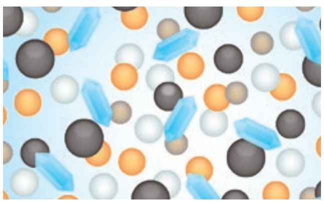
NATURAL MATERIAL

TEETHMATE™ DESENSITIZER is a natural material and extremely tissue-friendly. Unlike many other products, it is no problem if TEETHMATE™ DESENSITIZER comes into contact with the soft tissues. Its taste and smell are neutral, and the material leaves no discolouration. Moreover, the results are impressive.

CRYSTALLISATION



Start mixing TEETHMATE™ DESENSITIZER



Crystallization reaction

Hydroxyapatite (HAp)

: TTCP* : DCPA* : water : other : HAp

* TTCP; tetracalcium phosphate, DCPA; anhydrous dicalcium phosphate

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EVALUATION OF A CALCIUM PHOSPHATE DESENSITIZER USING AN ULTRASONIC DEVICE

In this study by Hajime Endo and colleagues from the Nihon University School of Dentistry in Tokyo, the effect of a calcium phosphate desensitizer on the demineralisation of animal dentin was evaluated by measuring changes in the transferred ultrasonic rate.

Dentin specimens with and without desensitizers were immersed twice daily for 10 minutes during the test period in a buffered 0.1 M lactic acid solution at a pH of 4.75. Between the lactic acid treatments, the specimens were stored in an artificial saliva solution (pH 7). The transfer rate of perpendicular ultrasonic waves was measured with a pulse receiver. The data were evaluated using one-way ANOVA, followed by the Tukey HSD test (α=0.05). The ultrasonic velocity decreased over time in specimens stored in a demineralising solution (3,785 - 3,462 m/s); however, specimens with an applied desensitizer showed a significantly higher sonic velocity (3,945 - 3,990 m/s) than those without application. The calcium phosphate desensitizer was found to reduce the demineralisation of dentin and sealed the dentin tubules.

INTRODUCTION

Dentin hypersensitivity is in principle caused by the movement of intratubular fluid shift after exposing dentin as a result of enamel loss and/or exposure of gingival root surface[1]. Dentin sensitivity arises from open dentin tubules at the tooth surface and is indicated by changes in temperature and pressure and by chemicals. A large number of exposed dentin tubules may cause an increased fluid shift, stimulating the nerves around the odontoblasts, leading to pain as mentioned in the hydrodynamic theory[2]. The general consensus is that the most effective and durable method of bringing relief is to seal the dentin surface using tubules sealing[3].

Different approaches are claimed to be effective in reducing or eliminating hypersensitivity. However, no desensitizer can be considered ideal for this purpose. There is a need for materials that can chemically react with and bond to tooth tissue, significantly reducing the possibility of reopening the dentin tubules. It has been shown that the reaction between tetracalcium phosphate (TTCP) and anhydrous dicalcium phosphate (DCPA) in a phosphate-based solvent leads to the formation of hydroxyapatite[4].

TEETHMATE™ DESENSITIZER is a material that contains TTCP and DCPA. It has been developed as a bioactive material to precipitate as a hydroxyapatite. This material reacts when it is brought into contact with bodily fluids and forms hydroxycarbonate apatite, a mineral similar to the mineral in dentin. The reaction between the TEETHMATE™ DESENSITIZER particles begins when the powder is mixed with the fluid. The reaction starts by the release of calcium and phosphate ions within seconds after the material has been mixed. The layer formed crystallises into hydroxyapatite. The reaction results in a physical seal of the dentin tubules, which reduces hypersensitivity.

DISCUSSION

This study evaluated the effect of a desensitizer (TEETHMATE™ DESENSITIZER) with calcium phosphate on the demineralisation of bovine dentin. Ultrasonic techniques were used to determine changes in the mineral content. The calcium phosphate cement-based desensitizer, TEETHMATE™ DESENSITIZER may create hydroxyapatite crystals, forming a local source to seal open dentin tubules. The LSM and SEM observations of the dentin discs demonstrated the usefulness of TEETHMATE™ DESENSITIZER in protecting against acid attacks during the tests. Although the crystal layer on the dentin disappeared during the acid treatment, the presence of precipitates in the dentin tubules in the TMO[I] and TMR[II] groups indicated the ability to reduce fluid shift.

The application of TEETHMATE™ DESENSITIZER resulted in the maintenance of the normal sonic rate. This is in contrast to the reduced rate as observed in the DE[III] group. This suggests that the TEETHMATE™ DESENSITIZER application prevented demineralisation.

One of the most important properties of TEETHMATE™ DESENSITIZER is related to its ability to cure in the presence of water under formation of hydroxyapatite. The application method of TEETHMATE™ DESENSITIZER is simple, and pre-treatment of the dentin surface is not necessary.

The application of the calcium phosphate desensitizer TEETHMATE™ DESENSITIZER, therefore, proved to have a beneficial effect in preventing dentin demineralisation.

CONCLUSION

The results suggest that the application of TEETHMATE™ DESENSITIZER in the tubules is effective in inhibiting dentin demineralisation. The obliteration of dentin tubules by repeated application of TEETHMATE™ DESENSITIZER prevents demineralisation, and the sealed dentin tubules reduce the dentin fluid shift, resulting in clinical improvement of dentin hypersensitivity.

Above text is based on the original scientific document.

Evaluation of a calcium phosphate desensitizer using an ultrasonic device.
Hajime ENDO, Ryo KAWAMOTO, Fuminori TAKAHASHI, Hirotaka TAKENAKA, Fumi YOSHIDA, Kie NOJIRI, Toshiki TAKAMIZAWA and Masashi MIYAZAKI, Department of Operative Dentistry, Nihon University School of Dentistry, 1-8-13 Kandasurugadai, Chiyoda-ku, Tokyo 101-8310, Japan, Dental Materials Journal 2013; 32(3): 456–461

[I] TMO: As DEiii, but with prior rubbing for 30 seconds with TEETHMATE™ DESENSITIZER. [II] TMR: As DEiii but with each test preceded by rubbing with TEETHMATE™ DESENSITIZER. [III] DE: immersed in lactic acid twice daily and stored in artificial saliva. .
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IN VITRO EVALUATION OF DENTINAL HYDRAULIC CONDUCTANCE AND TUBULE SEALING BY A NOVEL CALCIUM-PHOSPHATE DESENSITIZER.

In the current trend in materials used to treat dentin hypersensitivity, it is expected that calcium-phosphate-based desensitizers will have beneficial effects in the oral environment.

The study evaluated a newly designed desensitizer (CPD-100) containing tetracalcium phosphate and anhydrous dicalcium phosphate, compared to an oxalate desensitizer (SS**). In this in vitro study, the permeability reduction of the hydraulic conductivity was measured on etched dentin discs.*

Whereas in CPD-100, permeability decreased significantly over a four-week period when stored in artificial saliva, permeability in the oxalate-based desensitizer increased significantly. During observation of the SEM uptakes, newly formed crystals were observed on the dentin treated with CPD-100. This was not observed in the oxalate group. This would suggest that calcium oxalate inhibits the formation of calcium phosphate minerals. It was concluded that the newly developed calcium phosphate desensitizer has the potential to be stable in the oral environment in the long term as a result of its chemical properties to promote crystal growth upon contact with saliva.

INTRODUCTION

Calcium phosphate-based materials are potentially converted into hydroxyapatite as an end product, which is the basic mineral of teeth. The proximity of hydroxyapatite to natural tooth tissue and its biocompatibility make these materials usable in a variety of dental applications[1]. Human saliva also contains an abundance of calcium and phosphates. The oversaturation of saliva in relation to hydroxyapatite is expected to contribute to the further growth of hydroxyapatite in the oral environment[2]. Therefore, a calcium phosphate complex can potentially keep dentin tubules sealed in the long term. Hydroxyapatite-forming products are mainly used in bone replacement materials. (see also the chapter TEETHMATE™ DESENSITIZER Technology later on in this brochure). They have not yet been studied frequently for use as desensitizers. Oxalate types, on the other hand, have a fairly long history as desensitizers. Calcium oxalate deposition in the tubules reduces its permeability. However, the results of treatment with this are not long-lasting, because the calcium oxalate crystals are soluble in saliva.

DISCUSSION

Previous studies have shown that a mixture of TTCP and DCPA in an aqueous environment can be converted into hydroxyapatite. However, the degree of transposition depends on the TTCP/DCPA ratio.

The curing time of the mixture is about 30 minutes, a clinically undesirable time. For this reason, the hydraulic conductivity was measured 10 minutes after the application of both products in this study. Because effective permeability reduction was measured within this short period of time, this indicates that the curing capacity of CPD-100 may be increased in the presence of hydroxyapatite in dentin. Therefore, it can be suggested that a chemical bonding between the material layer and the smear layer-free dentin surface is likely to occur in a clinically acceptable time.

Unlike CPD-100, Super Seal has a dentin-demineralising effect due to its acidity and consumes the calcium in dentin prior to the formation of oxalate crystals, which, incidentally, immediately and effectively sealed dentin tubules. However, immersion in artificial saliva resulted in a decrease in the effectiveness of SuperSeal. This was in contrast to the control group and the CPD-100 group. This permeability increase was related to the disappearance of calcium oxalate crystals and the lack of formation of new crystals on the dentin surface and in the tubules. The increase in permeability may also be associated with the enlargement of the tubules' openings due to the acidic SuperSeal itself.

CONCLUSION

Application of both the calcium phosphate-based and the oxalate-based desensitizer showed effectively lower dentin permeability. The effectiveness of the former was better after immersion in artificial saliva. Consequently, the calcium phosphate-based material is expected to be a new generation within the desensitizers that promotes the growth of crystals. And it can be stable in the mouth for a long time.

Above text is based on the original scientific document.

In vitro evaluation of dentinal hydraulic conductance and tubulesealing by a novel calcium–phosphate desensitizer

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J Biomed Mater Res Part B 2012:00B:000–000.

* CPD-100 was the working name of TEETHMATE™ DESENSITIZER at the time of this study.

** SS = Super Seal, Phoenix Dental

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STUDIES

EFFECT OF DENTIN DESENSITIZERS ON RESIN CEMENTS BOND STRENGHTS

The calcium phosphate-based material TEETHMATE™ DESENSITIZER can serve as a useful new generation desensitizer, to be applied before the cementation of indirect restorations. This study aimed to evaluate the effect of dentin desensitizers on the bond strength of resin cement to dentin.

MATERIALS AND METHODS

Twenty bovine teeth were prepared until flat surfaces of medial dentin were obtained. A standardised smear layer was created with 600 grit SiC paper, immediately before the adhesive procedures. The surfaces of twenty 3 mm thick composite blocks (ESTENIA™ C&B, Kuraray Noritake Dental) were roughened with 50 µm of alumina and then silanised. The samples were randomly distributed among the following four groups (n=5): no treatment (control group), Gluma Desensitizer (GD, Heraeus Kulzer), Super Seal (SS, Phoenix Dental), and TEETHMATE™ DESENSITIZER (TMD, Kuraray Noritake Dental). The dentin surfaces were treated with ED Primer II (Kuraray). The composite blocks were attached to the dentin surfaces with the resin cement PANAVIA™ F2.0 (Kuraray Noritake Dental), in accordance with the manufacturer's instructions. After 24 hours of storage at 37ºC and 100% relative humidity, the bonded samples were cut into micro-specimens before measuring the tensile strength.

The data were analysed using one-way ANOVA and the Dunnett's test ($\alpha=0.05$). Scanning Electron Microscopy was used to assess the fracture modes.

RESULTS

The micro-tensile strengths µTBS were: 24.4 ±3.2 MPa (control), 14.0 ±5.6 MPa (GD), 8.6 ±4.7 MPa (SS) and 34.7 ±4.6 MPa (TMD); there were significant differences between the four groups ($p<0.05$).

CONCLUSIONS

The effectiveness of the desensitizers depends on the material; GD and SS lowered the µTBS, but TMD showed an increase. More studies on the mechanism of TMD, a calcium phosphate-based cement, are needed to explain this difference.

CLINICAL RELEVANCE

The calcium phosphate-based material TEETHMATE™ DESENSITIZER can serve as a useful new generation desensitizer, applicable before the cementation of indirect restorations.

Above text is based on the original scientific document.

Effect of dentin desensitizers on resin cements bond strengths.
Garcia R.N.[1,2] Tagaki T[3] Sato T.[3] Matsui N.[3] Nikaido T.[3] Tagami J.[3]
[1] University of the region of Joinville, Brazil. [2] University of Itajai Valley School of Dentistry, Brazil. [3] Department of Oral Health Care Sciences, Tokyo Medical and Dental University, Tokyo, Japan 5th International Congress on Adhesive Dentistry, June 14-15 2013, University of Pennsylvania, Philadelphia USA
RSBO. 2015 Jan-Mar;12(1)14-22

... AND MORE FROM OTHER STUDIES

Dentin hypersensitivity is a clinically relevant and population-wide problem. Although dentin hypersensitivity may affect about a quarter of the adult population, they don't often see the dentist as the right person to consult. It also seems that dentists themselves are not always fully informed on the aetiological or diagnostic concept of dentin hypersensitivity or its treatment, which can be explained by the gaps in research. Although dentin hypersensitivity is not considered a lethal problem, it affects the quality of life of patients and, therefore, it should be properly addressed in research, dental education, prevention, and treatment.

Source: Epidemiology of dentin hypersensitivity. Christian H. Splieth and Aikaterini Tachou. Centre for Oral Health, Ernst Moritz Arndt University Greifswald. Clin Oral Invest 2013 17 (Suppl 1):S3-S8.

There is a lack of clinical trials evaluating different types of dentin desensitizers over a period of six months. Some treatments with Cervitec Plus, SE Bond & Protect Liner F, laser and iontophoresis have shown satisfactory results after treatment in periods of three to six months.

Source: The effectiveness of current dentin desensitizing agents used to treat dental hypersensitivity: A systematic review. Wellington Luiz de Oliveira da Rosa, Rafael Guerra Lund; PhD, Evandr piva; PhD, Adriana Fernandes da Silva; PhD. Dept of Rest Dentistry, School of Dentistry, Federal University of Pelotas, Pelotas, Brazil. Quintessence Int 2013; 44:535-546.

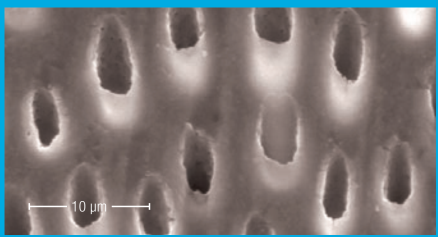
TREATMENT OF DENTIN HYPERSENSITIVITY AFTER CERVICAL EROSION

Before treatment

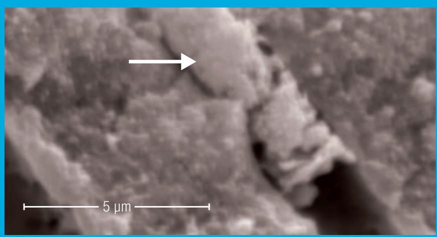
Treatment and photography: Dr Yuji Honda, Japan

TEETHMATE™ DESENSITIZER is rubbed with some force for 30 seconds on the surface to be treated.

The 22 shows gingival recession and produces dentin sensitivity. The tooth is cleaned with a fine abrasive and then carefully rinsed.



Open dentinal tubuli



HAp-integration of TEETHMATE™ DESENSITIZER

Source SEM photo's:
Kuraray Noritake Dental Inc.

TEETHMATE™ DESENSITIZER TECHNOLOGY

TEETHMATE™ DESENSITIZER IS A FURTHER DEVELOPMENT FROM THE AREA OF BONE REPLACEMENT MATERIALS AND IMPLANTOLOGY. BELOW IS AN OVERVIEW OF THE HISTORY AND TECHNOLOGY THAT PRECEDED THE DEVELOPMENT OF TEETHMATE™ DESENSITIZER.

The actual invention by Chow et al. was patented in 1996 (US pat. 5,525,148). This is a method of converting calcium phosphates into hydroxyapatite at room temperature by means of self-curing when they come into contact with an aqueous medium. It is important to use (moderately) soluble calcium phosphates that, at a high pH (alkaline) in solution, continue to contain a large quantity of phosphates (> 0.2 mol/l).

HISTORY

In earlier inventions (1970-1975), such as the use of calcium phosphate oxide as a pulp capping material, α and β calcium phosphate as a root canal filling material or dental reimplantation material, the components were also able to hydrolyse into hydroxyapatite. However, these materials are not capable of hardening to a solid, firm consistency.

Experiments with calcium-based implants to replace skull parts have been going on for years. Most of these implants are or were available in the form of prefabricated, sintered hydroxyapatite in granular or block form. These materials have quite a few disadvantages. For example, block-shaped hydroxyapatite implants have to be mechanically held in place, which does not improve the cosmetic result. Moreover, the granular variant has only limited structural stability. These materials are actually ceramic materials because the crystals are fused together at a high temperature during sintering. Under the name HA RESORB, a porous, non-resorbable material with a coral structure that allows ingrowth of bone was marketed. A granular, i.e. non-adhesive, hydroxyapatite. After application, a maximum of 20% bone is formed, and 80% of the material remains as scar tissue. There are also other examples. In summary, the commercially available hydroxyapatite materials are generally not resorbable and therefore cannot be substituted for bone and are not self-curing cements.

COMPATIBLE

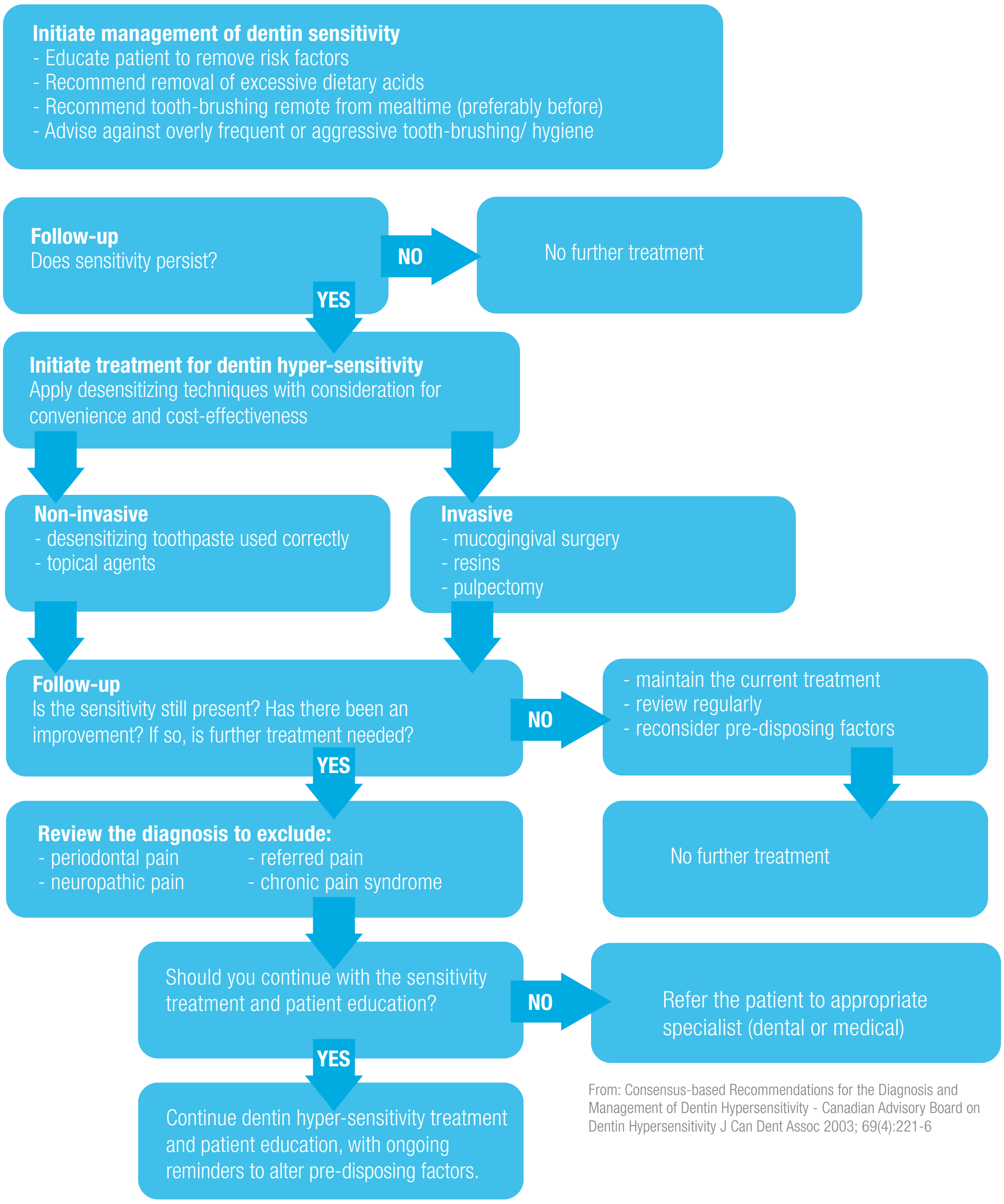
The main ingredients in a calcium phosphate cement or paste are tetracalcium phosphate (TTCP) and anhydrous dicalcium phosphate (DCPA) or dicalcium phosphate dihydrate (DCPD). These mixtures convert into hydroxyapatite in an aqueous environment. This is the main mineral in teeth and bones. Due to the apatite nature of the cured cement, it is highly compatible with soft and hard tissue. This material, when applied as a paste, forms a structurally stable implant consisting of microporous hydroxyapatite. The choice of cement ingredients and their proportions is important because, in a basic environment, a sufficient concentration of calcium and phosphate must remain to obtain a supersaturated solution, which is then quickly converted into hydroxyapatite. Rapid hydroxyapatite formation and solution of the calcium phosphates lead to curing within thirty minutes or less.

The basic technology for TEETHMATE™ DESENSITIZER has been developed by ADAF (American Dental Association Health Foundation) – Paffenbarger Research Center. The basic method for the manufacture of this material was developed by Dr Laurence C. Chow and Dr Shozo Takagi of this research center, in collaboration with Dr Akiyoshi Sugawara, dentist in Tokyo. To ensure optimal performance of the material as a desensitizer, Kuraray Noritake Dental made some changes in, among other things, the powder composition, preparation method, and additives.

Consult the following literature for more information about the basic technology:

1 Brown, W.E.; Chow, L.C.: A new calcium phosphate setting cement. J Dent Res, 62, 672, 1983.
2 Sugawara, A.; Chow, L.C.; Takagi, S.: An in vitro study of dentin hypersensitivity using calcium phosphate cement, J J Dent Mater, 8(2), 282-292, 1989.

TREATMENT ALGORITHM FOR DENTIN SENSITIVITY



From: Consensus-based Recommendations for the Diagnosis and Management of Dentin Hypersensitivity - Canadian Advisory Board on Dentin Hypersensitivity J Can Dent Assoc 2003; 69(4):221-6

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- Printed color can be slightly different from actual color.

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