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Tactics of Using Modern Materials for Prevention and Treatment of Enamel Damage During Erosion

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KEYWORDS

smooth shiny areas, antagonist teeth, boundaries, as a rule

ABSTRACT:

Typical clinical signs of erosion are the presence of a smooth, silk-glazed, sometimes dull surface with an intact enamel zone along the gingival margin. In later stages, further changes in morphology can be detected, resulting in the formation of a depression in the enamel that is wider than it is deep. Erosion on the vestibular surface of the teeth should be distinguished from wedge-shaped defects, which are located at the cement-enamel junction or apical to it. The coronal part of wedge-shaped defects, as a rule, has a sharp border and is located at a right angle to the surface of the enamel, and the "bottom" of the apical part reaches the surface of the root. Thus, the depth of the wedge-shaped defect exceeds its width. Erosive defects should also be differentiated from increased tooth abrasion, in which the defects are often flat, have smooth shiny areas with clear boundaries, and, as a rule, there are corresponding signs on the antagonist teeth.

Introduction

Interestingly, in most obvious cases of erosion of an exogenous nature, there is always a connection with behavioral and lifestyle factors. Thus, a relationship has been established between erosion and excessive consumption of specific foods such as citrus fruits, lemon and orange juice, fruit purees or fruit juices with pulp, soft drinks with cola additives and drinks with citrus additives. Frequent consumption of herbal teas, popular among the population and considered "healthy" drinks, may have a high erosive potential. Other researchers have noted that adding calcium to a sports drink reduces its erosive potential [85]. Additionally, a significant reduction in the erosive potential of a sports drink was shown when adding phosphopeptide-stabilized amorphous calcium phosphate, resulting in an increase in pH and a decrease in titratable acidity. Thus, it was noted that diluting drinks containing organic acids with high buffer capacity with water does not reduce the pH level, but reduces the titratable acidity. This seems important because the higher the buffer capacity of the drink, the longer it will take for saliva to neutralize the acid. However, dilution with water also reduces the concentration of calcium and phosphate (if present), which have a protective effect.

All methods of treating damage to tooth enamel and, as a result, hyperesthesia can be divided into 4 groups

1. Use of hygiene products designed for teeth with hyperesthesia.
2. Use of professional products to reduce tooth sensitivity by sealing dentinal tubules (adhesives, desensitizers, remineralizing therapy, deep fluoridation, surface sealants).
3. Filling defects.
4. Depulpation of teeth with increased sensitivity.

Modern technologies for treating dental hypersensitivity do not always have a long-lasting effect. Innovative technology for the prevention and treatment of dentin hypersensitivity during professional oral hygiene in patients with periodontal diseases. The most widespread are toothpastes containing argenine. To treat dentin hyperesthesia, Pro-Argin™ technology is used based on the formation of a complex of arginine and calcium carbonate. Domestic researchers have proven the effectiveness of using Sensodyne F toothpastes.

One of the latest developments from Glaxo Smith Kline Health care is a toothpaste containing 8% strontium

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acetate - Sensodyne Instant Effect. Strontium can influence the properties of dental tissues by entering isomorphically into the Ca position in the crystal structure of apatite, if there are free spaces. Using electron microscopy, it was found that a single treatment of a tooth section with Sensodyne toothpaste Instant effect in vitro leads to obturation of 93% of the dentinal tubules. Clinical trials have found that a single application of this toothpaste for 60 seconds leads to a significant reduction in the pain response to temperature stimuli, in particular to cold water. Remineralization therapy is one of the methods for treating caries at the spot stage. A number of studies have obtained long-term results confirming that this technique makes it possible to stop the development of the carious process at the spot stage by impregnating pathologically altered tissues with a methacrylate-based preparation, which stabilizes the development of caries and creates conditions for the restoration of damaged areas. Evaluation of the effectiveness of treatment of focal demineralization of enamel in the defect stage using the infiltration method in combination with various restoration technologies based on the results of the study. For remineralization therapy, professional fluoride and calcium-containing products are widely used, the action of which is aimed at reducing the sensitivity of dentin due to the precipitation of calcium fluoride crystals on the tooth surface. Comparative assessment of the clinical effectiveness of modern drugs for remineralization therapy. These complexes, by blocking dentinal tubules, reduce their permeability. However, the effect is short-lived since calcium fluoride crystals quickly disappear from the surface with chronic abrasion. A preparation has been developed that can be used for the production of toothpastes and powders. It represents an aqueous suspension of nano-sized material with a hydroxyapatite structure, including carbonate, fluorine groups and tricalcium phosphate:

(Ca10(PO4)6(OH)2 -x-y(Ca3)x/2Fy)0.9×(Ca3(PO4)2)0.1 where x=0.01-0.3; y=0.01-0.4 (2)

Materials and Methods

Particle sizes with a maximum in the region of 10-25 nm. To obtain the product, calcium hydroxide (at 2-5°C) is neutralized in an inert atmosphere of an aqueous-alcohol solution with a mixture of orthophosphoric and hydrofluoric acids, and at the last stage the neutralization rate is sharply increased. The resulting substance is close in chemical composition to tooth enamel and is completely biocompatible with human tissues. Nanocrystalline hydroxyapatite is synthesized by various methods, including: wet (precipitation from solutions), dry (solid-phase synthesis), hydrothermal and sol-gel methods. There is a method for neutralizing calcium oxide with acid in an aqueous solution, in which hydroxyapatite is obtained by precipitating the product with orthophosphoric and hydrofluoric acids. The concentration of carbonate ions in the solution is maintained constant by introducing Ca(HCO3)2. The synthesis is carried out at a temperature of 8-10°C, which ensures a particle size of the order of 35-60 nm [Pat. No. 2179437 RU. IPC A 61 K 7/16, A 61 K 33/06. Using scanning electron microscopy, a tight fixation of the Nanofluor varnish layer on the tooth surface was established, while the drug penetrates into the dentinal tubules and causes their obturation. The results of a study of the effectiveness of remineralization therapy using the drug “Apadent” containing nano-hydroxyapatite have appeared. It has been established that a course of remineralizing therapy with the drug "Apadent Professional®", which includes nano-sized hydroxyapatite particles, has a pronounced therapeutic effect in restoring the integrity of the enamel. The effectiveness of using a drug based on nanocrystalline medical hydroxyapatite to restore the integrity of the enamel after the end of treatment using fixed orthodontic equipment. The effectiveness of using Apadent Total Care toothpaste containing medical nano-hydroxyapatite has been confirmed. In the experiment, the Bass brushing method was used for 3 months with a brushing duration of at least 3.5 minutes [Evaluation of the effectiveness of long-term use of toothpaste.

“Amorphous, carbonated and fluorinated hydroxyapatite for toothpastes” is proposed, the composition of which includes a synthesized inorganic material with the structure of hydroxyapatite, containing, as can be seen from the formula, carbonate and fluorine groups:

Ca10(PO4)6(OH)2-x-y(CO3)x/2Fy, where x=0.01-0.3; y=0.01-0.4 (1)

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According to the authors, the resulting material is close in chemical composition to tooth enamel and is completely compatible with the human body, and therefore can be used in toothpastes. However, this material has low adhesion and mineralizing ability.

A preparation has been developed that can be used for the production of toothpastes and powders. It represents an aqueous suspension of nano-sized material with a hydroxyapatite structure, including carbonate, fluorine groups and tricalcium phosphate:

(Ca10(PO4)6(OH)2 -x-y(Ca3)x/2Fy)0.9×(Ca3(PO4)2)0.1 where x=0.01-0.3; y=0.01-0.4 (2). Particle sizes with a maximum in the region of 10-25 nm. To obtain the product, calcium hydroxide (at 2-5°C) is neutralized in an inert atmosphere of an aqueous-alcohol solution with a mixture of orthophosphoric and hydrofluoric acids, and at the last stage the neutralization rate is sharply increased. The resulting substance is close in chemical composition to tooth enamel and is completely biocompatible with human tissue.

Conclusion

Nanocrystalline hydroxyapatite is synthesized by various methods, including: wet (precipitation from solutions), dry (solid-phase synthesis), hydrothermal and sol-gel methods. There is a method for neutralizing calcium oxide with acid in an aqueous solution, in which hydroxyapatite is obtained by precipitating the product with orthophosphoric and hydrofluoric acids. The concentration of carbonate ions in the solution is maintained constant by introducing Ca(HCO3)2. The synthesis is carried out at a temperature of 8-10°C, which ensures a particle size of the order of 35-60 nm [Pat. No. 2179437 RU. IPC A 61 K 7/16, A 61 K 33/06. Amorphous, carbonated and fluorinated hydroxyapmite for toothpastes and a method for its preparation. Today in our country there is a known method for producing medical nanocrystalline silicon-containing hydroxyapatite with an average crystal size of 3-30 nm, with a specific surface of 20-130 m2/g, which has high biocompatibility and bioresorbability. It has been established that the introduction of silicate ions into the crystal lattice of HAP leads to a decrease in the crystal size by almost 3-6 times [Pat. No. 2500840 RU. IPC C 30 B 29/14, C 01 B 25/32, C 01 B 33/24, A 61 L 27/12, B 82 B 3/00, B 82 Y 30/00. Method for producing nanocrystalline silicon-substituted It has been established that “Si-HAP”, being a biocompatible material, does not cause changes in surrounding tissues. A tendency has also been established to increase the bioresorbability of “Si-HAP” in the case of increasing the degree of substitution of phosphate ions with silicate ions. Colloidal chemical aspects of the synthesis of hydroxyapatite modified with silicate ions.

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