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Remineralizing agents in dentistry: A review

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Abstract

Several remineralizing agents helps in remineralization of the carious lesion by replenishing lost minerals like calcium, phosphate ions into the tooth structure. Several *in vitro* and *in vivo* studies have proven that these agents have proven to be useful in the treatment of white spot lesions, early childhood caries, dental erosion, root caries, and dentin hypersensitivity. They are delivered in the form of oral hygiene products such as chewing gum, tooth cream, and even incorporated in dental restorative materials also. The present article highlights different remineralizing agents used in dentistry with their mechanism of action.

Keywords: Remineralizing agents, dentistry

Introduction

Dental Caries is the most prevalent chronic diseases worldwide, and a burden to health-care services. The treatment of dental caries is expensive, accounting for between 5% and 10% of total health-care expenditures in industrialized countries [1]. Dental hard tissues are continuously undergoing cycles of demineralization and remineralization. A drop in pH of oral cavity results in demineralization which if continued leads to loss of minerals from tooth structure resulting in dental caries [2]. If the disease has progressed significantly, more drastic measure has to be taken, i.e., surgical intervention, where we treat the disease not the cause. It has taken over a century for dentistry to advance from the pioneering "extension for prevention" concept to a newer concept "minimum intervention." Minimum intervention as the term suggests refers to the principle of treatment in dentistry, in which early intervention minimizes tooth destruction because the disease is diagnosed prior to the destruction of the tooth. Hence, it is possible to remineralize the carious lesion [3].

Flouridated and Non-flouridated agents cause the remineralisation of the carious lesions. Flouridated agents increases caries resistance may arise from both systemic and topical applications of fluoride and can be broadly grouped as follows - increased enamel resistance, increased rate of maturation, remineralization of incipient caries, interference with micro-organisms and improved tooth morphology [4].

Present article highlights the uses of non-fluoridated agents like Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) [RecalDent, GC Tooth Mousse], Tricalcium Phosphate [ClinPro,3M ESPE], Bioactive Glass [NovaMin], Xylitol, Unstabilised Calcium Phosphate with Sodium Fluoride [Enamelon], Arginine Bicarbonate calcium carbonate complex [Cavistat], Calcium carbonate carrier [Sensistat], Grape Seed Extract, Ozone [HealOzone] in preventing demineralization of Carious Lesion.

Casein Phosphopeptide- Amorphous Calcium Phosphate-(CPP-ACP) [5]

Casein, a milk phosphor-protein, interacts with calcium and phosphate. As the pH of the material increases, the bound form of amorphous calcium phosphate increases thereby stabilizing free calcium and phosphate.

CPP stabilizes the calcium and phosphate ions in dental plaque and dental enamel. CPP keeps the calcium and phosphate in amorphous state, noncrystalline state that helps them to enter the tooth enamel. CPP stabilizes ACP, thereby maintaining state of supersaturation of calcium and phosphate, reducing demineralization and increasing remineralization.

Amorphous Calcium Phosphate (ACP) [5]

It acts as a reservoir of calcium and phosphate for dental enamel. ACP was present in a dentifrice called Enamelon also contained unstabilised calcium and phosphorous with fluoride. This formulation delivers fluoride to the site thereby causing remineralisation of the enamel.

Tricalcium phosphate [6]

Tricalcium phosphate, a newer remineralizing agent, when comes in contact with tooth surface and moistened by saliva, the protective barrier breaks making available calcium, phosphate and fluoride. Clinpro is Tricalcium phosphate, constituting calcium oxides, calcium phosphates and free phosphates. Tricalcium phosphate along with 950 ppm fluoride increases microhardness of the tooth structure.

Bioactive Glass [7]

Bioactive glass, a biomimetic material, affects the signaling pathway, thereby restoring the tooth structure. NovaMin contains Bioactive glass, and calcium sodium phosphosilicate. It has antimicrobial activity towards *Streptococcus mutans* and *Streptococcus sanguis*. It aids in remineralization of tooth structure especially in patients with systemic problems.

Xylitol [7, 8, 9]

Xylitol, a non-acidogenic sweetener, interferes with plaque formation and its adhesion to the tooth surface. It neutralizes the plaque pH by decreasing the lactic acid formation. Also it reduces the levels of *S. mutans* and assists in remineralization of the tooth structure. It acts by inhibiting the metabolism of *S. mutans*. Studies have shown xylitol causes the net reduction in caries is by 83-99%.

Grape Seed Extract [9]

Grape seed extract contains polyanthocyanidin which is an antioxidant and which interacts microbial cell membrane proteins, and lipids resulting in lysis of cell membrane thereby resulting in arrest of root caries. It inhibits the glucosyltransferase enzyme produced by *S. mutans* resulting in inhibition of Dental Caries. Grape seed extract is a potent substitute for fluorides for the prevention of root caries in elderly patients.

Cavistat [10]

An arginine bicarbonate and calcium carbonate (Cavistat) complex has been capable of preventing the development of dental caries and it prevents caries upto 50%. It is one of the most prevalent and economical method of caries reduction.

Challenges in Remineralization

Active carious lesions are more remineralizable than non active lesions. The penetration of the ions in the carious part is much better than the non carious part. Possible approaches are microabrasion, acid etching, deproteination or combination. *In vitro* studies are not much effective in predicting the results and more number of *in vivo* studies are required for the same. [9]

Conclusion

Demineralization and remineralization of tooth structure is a continuous process. The remineralization process can be seen in incipient carious lesions. The nonfluoride remineralization technologies can benefit many. With newer nonfluoride

techniques, we can reestablish the health of oral tissues without adverse effects of fluorides.

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