
REVIEW ARTICLE

Herbal Remineralizing Agents

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ABSTRACT

Minimal intervention is a necessity nowadays in dentistry. Minimal intervention dentistry (MID) emphasizes minimum invasive treatment plans possible for less loss of tissue and discomfort for patients. MID focus on prevention and early intervention of caries, instead of the traditional surgical approach for early surface lesions, it emphasizes on biological or therapeutic approach for remineralization of early carious lesions. Depending upon the environment around the tooth, these agents aimed at controlling the demineralization- remineralization cycle. This article gives details about various agents that improve remineralization and discusses their clinical implication. Revitalizing dentin in the deep carious lesion is vital for pulp protection. It is hard to remineralize dentin. Nowadays, dentistry emphasizes preserving dentin to the maximum extent possible by remineralization of demineralized dentin via biomimetic strategy and non-invasive treatment modalities using various remineralizing agents. Dental caries has been a multifactorial disease and a major public health problem worldwide. Hence it is necessary to use remineralizing agents on non-cavitated lesions for a non-invasive management approach. This review aims to update regarding the different remineralizing agents used in dentistry and their mode of action.

Keywords: Herbal, Remineralizing agents, Minimal intervention, Non-invasive

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INTRODUCTION

Aesthetic dentistry is a branch of dentistry in which the primary focus is the variety of functional and structural advent of patient's oral structures, in combination with the treatment and prevention of oral disease. Restoring decayed teeth aesthetically is also a part of aesthetic dentistry. The cycle of demineralization-remineralization takes place during the caries process, which might be either reversible or irreversible based on the stage of caries progression. White spot lesions are indicators of the initial stage of caries progression and can be reversed, but if the stage of demineralization continues, it will lead to cavitation [1]. In the present-day, non-invasive management of non-cavitated carious lesions by remineralization is being stressed to avert disease progression and to advance the strength and aesthetics of teeth. Fluorides are considered as mediators to impede demineralization and endorse remineralization. Applying fluoride on the enamel surface causes replacement of hydroxide ions in the hydroxyapatite crystal structure of the teeth and the formation of fluorapatite [2]. At lower pH, the higher acid resistance of enamel prevents the dissolution of the fluorapatite as opposed to hydroxyapatite. Hence, decreasing the point at which demineralization occurs and also fluoride reduces the critical pH from about 5.5 to 4.5 [3].

CLASSIFICATION

The common herbal remineralizing agents are:

- Xylitol
- Grape seed extract
- Yoghurt extract

- Leaf extract
- Hesperidin
- Galla Chinensis

The rationale for providing an alternative to remineralising agents

Fluorides have a limited effect on pits and fissure caries prevention and the risk of fluorosis due to overexposure cannot be overlooked. The remineralizing capacity of fluoride is also determined by the availability of phosphate and calcium ions in the surrounding oral environment [3].

The following are the Requirements of a remineralizing agent:

- Calcium and phosphate distribute into the sub-surface of the tooth.
- Formation of calculus should not be indorsed.
- Work competently during a carious attack at acidic pH to avert demineralization.
- Remineralizing properties of saliva should be enhanced.
- In the absence or reduced salivary flow, should be able to work.Eg. Xerostomia.
- To decrease caries in high-risk patients, should be able to use an aide to preventive therapy.
- Reduction of teeth erosion in the patients with gastric reflux or other disorders.
- Decrease decalcification in orthodontic patients.
- In cases involving white-spot lesions, repairing of enamel.
- Should be useful in cases of before and after teeth whitening and to desensitize sensitive teeth [4, 5].

HERBAL REMINERALIZING AGENTS

(a) Xylitol

Xylitol is a non-fermentable sugar alcohol, produced from xylan-rich hardwood such as birch and beech wood. Because of its anticarcinogenic effects, it causes deactivation of *S. mutans* and inhibition of plaque's ability to produce acids and polysaccharides. When consumed as chewing gums, it results in increased buffering capacity against acids and its high mineral content provides the minerals to remineralize the tooth. It also stimulates and increases salivary flow [6]. Xylitol does not lower the pH of plaque hence is not fermented by cariogenic bacteria, thereby preventing demineralization and proliferation. Miake *et al* [7] did a study to determine the remineralization effects of xylitol on enamel. They concluded that 20% xylitol induced remineralization at deeper depths of around 50 to 60µm by increasing calcium ion accessibility and movement.

(b) Grape Seed Extract

Grape Seed extract contains proanthocyanidin (PA) which is a type of polyphenol. Polyphenols are plant-derived substances that have anti-inflammatory and antioxidant properties. Proanthocyanidin acts via accelerating the conversion of soluble to insoluble collagen. Collagen matrices which are subjected to proanthocyanidin are biocompatible and inhibit the activity of enzymes like amylase, glucosyltransferase and F-ATPase. PA inhibits glucosyl-transferases which are produced by *Streptococcus mutans*, thereby resulting in caries inhibition. A study conducted by Zhao *et al*⁸ demonstrated that 1, 2 and 3mg/mL grape seed extract inhibited the progression of artificial enamel caries lesion. Epasinghe *et al* [9] conducted an in vitro study and concluded that proanthocyanidin when combined with CPP-ACFP (CPP amorphous calcium fluoride phosphate) shows a synergistic effect on remineralization of artificial root caries.

(c) Yoghurt Extract

Milk proteins get adsorbed on the enamel surface thereby inhibiting the demineralization of enamel. It also plays a part in reducing the growth of cariogenic bacteria. Calcium ions are released from yoghurt at acidic pH thus aiding the remineralisation of enamel [10]. A study by Varghese *et al*¹¹ proved that yoghurt extract was effective in inhibiting enamel demineralization. Another study showed that yoghurt extract enhances saliva secretion which may contribute to its remineralizing properties [12].

(d) *Psidium Cattleianum* Leaf Extract

The flavonoids are the main components present in it. These flavonoids and tannin acid have antibacterial activity (predominantly kaempferol, quercetin and cyanidin). It aids in remineralization by the formation of a collagen matrix scaffold for deposition. It impedes protein expression required for carbohydrate metabolism in *S. mutans* and as a result, inhibits membrane. The membrane-associated proteins like glycosyltransferases also get inhibited as a result. Brighenti *et al* [13] conducted a study and concluded that *Psidium cattleianum* aids in enamel remineralization in situ. Crivelaro de Menezes TE *et al* [14] observed that *Psidium cattleianum* aqueous extracts increase their microhardness and improve enamel remineralization.

(e) Hesperidin

Hesperidin is a flavanone glycoside and was first isolated by Lebreton from the white inner citrus peels. It encourages remineralization and acts by interacting with the collagen matrix. This acts as a scaffold for the deposition of minerals and stability of collagen matrix and results in remineralization as collagen matrix.

As compared to the inactive lesion, active white spot lesions are more prone to undergo remineralization [15]. As they present a porous surface that allows penetration of ions. This can be achieved by the following:

- Acid etching [16]
- Micro-abrasion [17]
- Bleaching/ Deproteinization [18, 19] or their combination.

Another challenge with these herbal remineralizing agents is that their effects have been so far having been seen only in preclinical scenarios. Therefore, studies fully exploring their potency in clinical settings need to be undertaken [2].

(f) *Galla Chinensis* (*G. Chinensis*)

It is one of the traditional natural, non-toxic Chinese herb, that has been used for the past 2,000 years. Previous studies have indicated that *G. Chinensis* had an ability to inhibiting cariogenic bacteria [4, 22] enamel demineralization and enhancing remineralization [5, 22]. A previous study [23] reported the use of GC along with fluoride in increasing remineralization. But studies to explore the synergistic effect of GC with calcium of remineralization are yet to be conducted. So far, no biofilm model has persuasively addressed the effectiveness of caries-preventive agents such as traditional herb on remineralization of dental hard tissue.

CONCLUSION

Remineralizing agents are the newer generation of dentistry that depends on the microenvironment that surrounds the tooth and focused on controlling the demineralization or remineralization cycle. By using a biological approach as opposed to a traditional surgical approach, with the use of these herbal agents, we can provide quality dental care through the minimally invasive option that is more acceptable to both the dentist and patient.

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