

Biom mineralization induced by chitosan and collagen-based materials with fluoride for dentin coverage: Chemical and morphological analysis

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Abstract

The prevention and treatment of erosive tooth wear are becoming increasingly important due to its increasing prevalence. The use of natural solutions to modify dental surfaces has become an area of research. Organic materials such as chitosan and hydrolyzed collagen may be a promising option to treat dentin. This in vitro study aimed to evaluate the influence of chitosan or hydrolyzed collagen, alone or combined with acidulated phosphate fluoride (APF) gel, on the composition and morphology of dentin after erosion. Bovine dentin samples were prepared ($n = 84$) and treated with artificial saliva (AS, negative control); APF gel (F, positive control); chitosan solution (Chi); hydrolyzed collagen solution (Col); fluoride/chitosan composition (F_Chi); and fluoride/hydrolyzed collagen composition (F_Col). Erosive cycles (six cycles of immersion in orange juice for 1 min, followed by immersion in AS for 1 hr) were performed. The materials were characterized by their morphology, composition, and particle size distribution. Micro-energy dispersive X-ray fluorescence spectroscopy and scanning electron were used to evaluate the dentin's inorganic chemical composition and morphology. The F_Col and F groups had a reduction in calcium loss by 17 and 26%, respectively ($p < .001$). Both of these groups still had a covering layer of agglomerates at the dentin surface after the erosive cycles. The fluoridated chitosan or collagen solutions improved the dentin resistance to erosion as a novel hybrid-fluoride-based material approach to provide surface protection from erosion.

KEYWORDS

chitosan, collagen, dentin erosion, micro-energy dispersive X-ray fluorescence spectroscopy, scanning electron microscopy

1 | INTRODUCTION

Dental erosion (recently renamed corrosion) is an irreversible chemical process that causes the loss of the inorganic phase of the tooth by acidic substances without the involvement of bacteria (Ganss, Klimek, & Schlueter, 2014; Ganss, Lussi, Grunau, Klimek, & Schlüter, 2011; Nahorny et al., 2017). The erosive process affects both enamel and dentin. However, the progression is faster in dentin

than in enamel because of the elevated organic portion in the latter (de Souza et al., 2021).

The traditional and most accessible method for the treatment and prevention of dental erosion is the use of fluoridated products. Topical fluoride pretreatment can be used to prevent erosion, but it is only partially effective and requires an intensive fluoridation regimen to obtain significant protection (Ganss, Klimek, Brune, & Schürmann, 2004).