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Article

Preparation and Characterization of a Novel Hydroxyapatite-Capsaicin Composite Intended for the In-Office Dental Bleaching Use

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Abstract: The aim of this study was to synthesize a hydroxyapatite-capsaicin composite (HAp-CAP) and to evaluate its physicochemical data for further use in hydrogen peroxide in-office dental bleaching gel. The HAp-CAP was prepared by the precipitation method, performed in a 4:1 ratio using 3.2 g of nano-hydroxyapatite (nano-HAp) and 0.8 g of capsaicin (CAP) in 99.5% ethyl alcohol (q.s.p) and zirconia beads at SpeedMixer[®]. The HAp-CAP was characterized by morphological, spectroscopic, and thermal analyses. In the following, the HAp-CAP was added to an in-office dental bleaching to test its effect on reducing hydrogen peroxide diffusion into the pulp chamber, as well as the effect in the color alteration during dental bleaching. The HAp-CAP were suitably obtained by the precipitation method, and the results demonstrates that the thermal stability of the CAP is greatly improved after reaction of HAp and CAP. The HAp-CAP into a bleaching gel slightly decreased the amount of hydrogen peroxide inside the pulp chamber and didn't interfering in the bleaching effectiveness of dental bleaching. The HAp-CAP synthesis and characterization were successfully carried out, and its use in dental materials is a challenging task that needs further study since its addition.

Keywords: dental enamel permeability; tooth bleaching; hydrogen peroxide; tooth sensitivity; TRPA-1 receptors

1. Introduction

Dental bleaching is one of the most common procedures performed in aesthetic dentistry to reduce patients' frustration with dental color color [1, 2]. Among the dental bleaching techniques, the in-office approach that uses high-concentration hydrogen peroxide gels [3, 4] is highly requested by patients since it provides faster results [3, 5].

However, the main disadvantage of using more concentrated hydrogen peroxide gels is the increased rate of beaching-induced tooth sensitivity (TS) [6-9]. TS is generally related to the ability of hydrogen peroxide to penetrate through enamel and dentin after gel application [10, 11] and to promote oxidative stress in pulp cells with the release of inflammatory mediators [10, 12-14] as well as the intrinsic sensitivity to pain from each patient [8]. Therefore, the higher the hydrogen peroxide concentration in dental pulp, the higher TS is observed [3, 15], because the concentration of bleaching gel applied may influence the amount of hydrogen peroxide that reaches the pulp chamber [15, 16].