

Effect of Tooth Bleaching Agents on Enamel Demineralisation

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Abstract : Background: Tooth discoloration can be an aesthetic problem, and tooth whitening using carbamide peroxide bleaching agents are a popular treatment option. However, there are concerns about possible adverse effects such as demineralisation of the bleached enamel; however, the cause of this demineralisation is unclear. Introduction: Teeth can become stained or discoloured over time. Tooth whitening is an aesthetic solution for tooth discoloration. Bleaching solutions of 10% carbamide peroxide (CP) have become the standard agent used in dentist-prescribed and home-applied 'vital bleaching techniques'. These materials release hydrogen peroxide (H_2O_2), the active whitening agent. However, there is controversy in the literature regarding the effect of bleaching agents on enamel integrity and enamel mineral content. The purpose of this study was to establish if carbamide peroxide bleaching agents affect the acid solubility of enamel (i.e., make teeth more prone to demineralisation). Materials and Methods: Twelve human premolar teeth were sectioned longitudinally along the midline and varnished to leave the natural enamel surface exposed. The baseline behavior of each tooth half in relation to its demineralisation in acid was established by sequential exposure to 4 vials containing 1ml of 10mM acetic acid (1 minute/vial). This was followed by exposure to 10% CP for 8 hours. After washing in distilled water, the tooth half was sequentially exposed to 4 further vials containing acid to test if the acid susceptibility of the enamel had been affected. The corresponding tooth half acted as a control and was exposed to distilled water instead of CP. The mineral loss was determined by measuring $[Ca^{2+}]$ and $[PO_4^{3-}]$ released in each vial using a calcium ion-selective electrode and the phosphomolybdenum blue method, respectively. The effect of bleaching on the tooth surfaces was also examined using SEM. Results: Exposure to carbamide peroxide did not significantly alter the susceptibility of enamel to acid attack, and SEM of the enamel surface revealed a slight alteration in surface appearance. SEM images of the control enamel surface showed a flat enamel surface with some shallow pits, whereas the bleached enamel appeared with an increase in surface porosity and some areas of mild erosion. Conclusions: Exposure to H_2O_2 equivalent to 10% CP does not significantly increase subsequent acid susceptibility of enamel as determined by Ca^{2+} release from the enamel surface. The effects of bleaching on mineral loss were indistinguishable from distilled water in the experimental system used. However, some surface differences were observed by SEM. The phosphomolybdenum blue method for phosphate is compromised by peroxide bleaching agents due to their oxidising properties. However, the Ca^{2+} electrode is unaffected by oxidising agents and can be used to determine the mineral loss in the presence of peroxides.

Keywords : bleaching, carbamide peroxide, demineralisation, teeth whitening

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