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Spectroscopic Evaluation the Effect of a New in-office Bleaching Material on Enamel Surface

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Objective: The purpose of this study was to investigate the effect of a new in-office bleaching gel at different concentrations of hydrogen peroxide (HP, 6%, 12% and 18%) on the tooth surface morphology and mineralization.

Methods: Third sound molars were extracted and collected for the present study. Teeth, showing the presence of lesions and decays, including white spots, were excluded from this study. After the surgical extraction, the teeth were cleaned with distilled water to remove blood and biological remnants. Teeth were stored in a 0,5% (w/w) chloramine solution (NH_2Cl). Subsequently, molars were cut using a diamond disk coupled to a hand-piece and the crowns were sectioned mesio-distally in two halves containing the buccal or lingual enamel surface. For each molar, one hemi-section (A) was randomly assigned to a bleaching treatment, while the other one (B) was used as controls (no treatment) or using a conventional bleaching gel (in one case). The following experimental groups (n = 3 teeth for each group) were made, subjected to different bleaching treatments as specified:

***Group 1*:** A 6% HP experimental bleaching gel (BioWhiten ProOffice; Alkaline HP (pH ≥ 7.5) and Nano-Hydroxyapatite); B used as control (no treatment) .
***Group 2*:** A 12% HP experimental bleaching gel (BioWhiten ProOffice; Alkaline HP (pH ≥ 7.5) and Nano-Hydroxyapatite); B 10% of Carbamide peroxide (CP) (3,6% of HP) conventional bleaching gel (White Dental Beauty, Novon, Optident).
***Group 3*:** A 18% HP experimental bleaching gel (BioWhiten ProOffice; Alkaline HP (pH ≥ 7.5) and Nano-Hydroxyapatite); B used as control.
***Group 4*:** A 10% CP conventional bleaching gel; B used as control.

The bleaching agents were applied for all specimens with the same protocol, following the manufacturer's instructions. Bleaching treatment was applied for 10 minutes, repeating the treatment 5 times, waiting 5 minutes between each application. After each application, gel was removed using a saliva aspirator. Thus, the bleaching material was in contact with the dental surface for a total of 50 minutes. The effects of bleaching were evaluated by Spectrophotometer FT-NIR (Perkin Elmer Spectrum One) in order to analyze the changes in the chemical structure, caused by the application of whitening gels on the inorganic matter of the dental mineralized tissue, and the Demineralization Degree (DD) of the enamel surface. Scanning Electron Microscopy was used to qualitatively evaluate the morphology of the treated dental hard tissues.

Preliminary Results: Figure 1 shows the graph of the spectra acquired. For this study, peaks at 6978 cm^{-1} and 5166 cm^{-1} were analyzed to understand the crystallinity of hydroxyapatite, while figure 2 shows the absorbance spectra of the different samples in second derivate.

Fig.1.

FT-NIR spectrometer evaluation

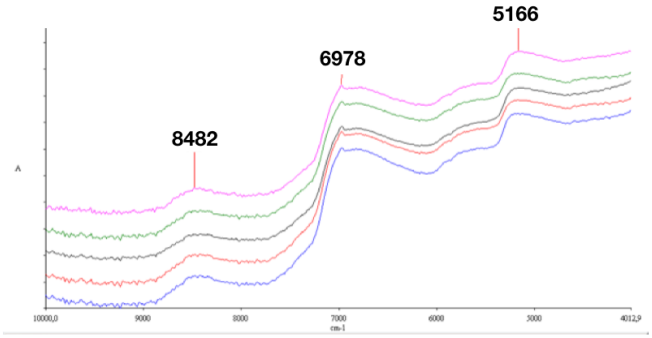
NIR absorbance spectra (10000-4000 cm^{-1}) of different Bleaching Agent according to Protocol

Spectral range: 10000-4000 cm^{-1}

Spectra resolution: 16 cm^{-1}

Analyzed bands:

- 6978 cm^{-1} (first overtone of structural OH)
- 5166 cm^{-1} and 8482 cm^{-1} (combination bands of surface P-OH)

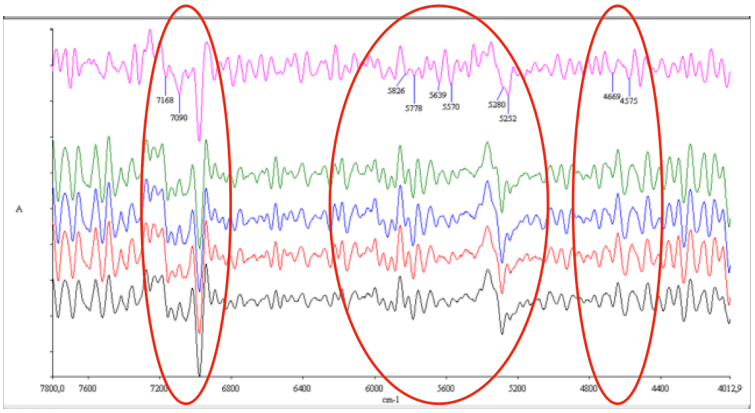


CONTROL	HP 6%	HP 12%	HP 18%	CP 10% HP 3,6%
	Experimental gel	Experimental gel	Experimental gel	Conventional gel

Fig. 2.

FT-NIR spectrometer evaluation

NIR absorbance spectra (10000-4000 cm^{-1}) in second derivative



CONTROL	HP 6%	HP 12%	HP 18%	CP 10% HP 3,6%
	Experimental gel	Experimental gel	Experimental gel	Conventional gel

Conclusions: Conventional gel spectrum shows many differences respect to the Control group spectrum, while the remaining experimental gel spectra follow the trend. Therefore, according to this analysis, it seems that the Experimental gel does not modify/destroy the enamel chemical composition after 50 minutes of application.