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Effect of an experimental desensitizer with a hydroxyapatite-capsaicin composite applied before in-office dental bleaching on hydrogen peroxide diffusion, color and surface changes

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Abstract

Objective

To evaluate a prior application of an experimental desensitizer containing a hydroxyapatite-capsaicin composite (HAp-CAP) in different concentrations on hydrogen peroxide (HP) diffusion into the pulp chamber, bleaching efficacy (BE) and on physical and chemical alterations of the enamel surface after in-office bleaching.

Materials and methods

Forty sound premolars were randomized in five groups according to each experimental condition ($n = 8$): no bleaching (negative control), only bleaching (positive control), 0.1%, 1% and 5% of HAp-CAP. Four groups were submitted to in-office bleaching (HP 35%) post-desensitizer application. The HP concentration (µg/mL) on the pulp chamber was measured by UV-Vis spectrophotometer. The BE was measured by digital spectrophotometer (ΔE_{ab}, ΔE_{00} and ΔWI_D) before and after 7 days bleaching. Enamel tooth fragments obtained from twenty molars were submitted to the same experimental conditions and analyzed using FE-SEM and EDS, Vickers microhardness (VHN), Raman spectroscopy, and nanoroughness (Ra) by AFM to evaluate morphologic and chemical changes on enamel surface. All data were submitted to statistical analysis ($\alpha = 0.05$).

Results

The groups treated with HAp-CAP exhibited a lower concentration of HP in the pulp chamber compared to only bleaching group ($p < 0.05$). There were no significant differences observed in BE between HAp-CAP groups and only bleaching group ($p > 0.05$). Only HAp-CAP 5% showed no significant differences in VHN values when compared to no bleaching group ($p > 0.05$). There were no significant differences among any group in Ra values ($p > 0.05$). The groups submitted to HAp-CAP showed a higher mineral concentration when compared to only bleaching group ($p < 0.05$).

Conclusion

Desensitizers containing HAp-CAP up to 5% effectively reduce HP diffusion into the pulp chamber after in-office bleaching, without interfering to BE and Ra, as well as prevent enamel demineralization.

Clinical relevance

The use of desensitizers containing HAp-CAP during in-office bleaching treatments offers a promising approach to reduce the risk of pulp irritation caused by hydrogen peroxide diffusion, without compromising the bleaching effectiveness or causing surface roughness.

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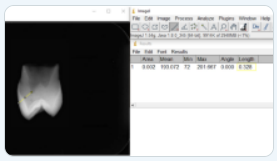

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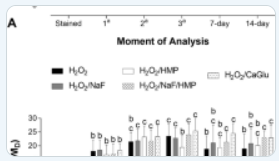

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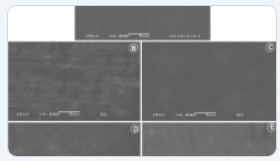

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Data availability

No datasets were generated or analysed during the current study.

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CRediT (Contribuidor Roles Taxonomy)Conceptualization [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Maria Cristina Rockenbach Binz Ordóñez, Alessandro D. Loguercio, Paulo Vitor Farago]; Data curation [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Alessandro D. Loguercio, Paulo Vitor Farago]; Formal analysis [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Alessandro D. Loguercio, Paulo Vitor Farago]; Funding acquisition [Alessandro D. Loguercio, Paulo Vitor Farago]; Investigation [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Claudia González, Maria Cristina Rockenbach Binz Ordóñez, Alessandro D. Loguercio, Paulo Vitor Farago]; Methodology [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Alessandro D. Loguercio, Paulo Vitor Farago]; Project administration [Alessandro D. Loguercio, Paulo Vitor Farago]; Resources [Alessandro D. Loguercio, Paulo Vitor Farago]; Software [Byron Carpio-Salvatierra, Alessandro D. Loguercio, Paulo Vitor Farago]; Supervision [Alessandro D. Loguercio, Paulo Vitor Farago]; Validation [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Claudia González, Maria Cristina Rockenbach Binz Ordóñez, Alessandro D. Loguercio, Paulo Vitor Farago]; Visualization [Alessandro D. Loguercio, Paulo Vitor Farago]; Writing–Original Draft [Byron Carpio-Salvatierra, Karine Leticia Da Silva]; Writing–Review & Editing [Byron Carpio-Salvatierra, Karine Leticia Da Silva, Michael Willian Favoreto, Claudia González, Alessandro D. Loguercio, Paulo Vitor Farago].

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Ethics declarations

Ethical approval

This study was approved by the State University of Ponta Grossa (PR/ Brazil) ethics committee (protocol number 6.051.483).

Informed consent

Not applicable.

Competing interests

The authors declare no competing interests.

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