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HYDROGEN PEROXIDE AND OXYGEN KINETICS IN ENAMEL SURFACE

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INTRODUCTION & OBJECTIVES

Tooth bleaching techniques are most probably based in the capability of bleaching agent to generate reactive oxygen species from hydrogen peroxide H_2O_2 or carbamide peroxide.[1] Oxygen (O_2) is a polymerisation inhibitor of 2,2-bis[4-(2-hydroxy-3- methacryloxypropoxy) phenyl] propane (Bis-GMA) and triethyleneglycol dimethacrylate (TEGDMA).[2]

The study of these agents in enamel surface is interesting and needs further understand concerning biological effects and restorative treatments consequences. Following previously research focused in oxygen identification in dental enamel by micro Raman [3],

- **the objective of this** *in vitro* **study was to establish the H_2O_2 and oxygen (O_2) kinetics in enamel surface following a tooth bleaching procedure, using confocal micro Raman spectroscopic technique.**

MATERIALS & METHODS

3 anterior sound teeth were used. Cuts were made in order to obtain a total of 9, 2x2 mm buccal enamel samples. A bleaching product containing 40% hydrogen peroxide (Opalescence Boost) was applied to these samples, for 1 hour, rinsed with water and dried immediately before measurements. Samples were measured with confocal micro Raman spectrometer equipped with a laser diode source operating at a wavelength of 532 nm. The incident laser power applied to the sample was 8 mW. The spectral ranges investigated were 800 cm-1 to 1700 cm-1 using a pinhole of 500 µm, a 100 µm slit and a 1800 g/mm grating. Pictures have been taken with a BX41 Olympus microscope using x10 and x100 magnification and equipped with a Ueye 1640 camera. Integrated intensities have been calculated for the peak assigned to O_2, phosphate (PO_4) and H_2O_2, then the ratios O_2/PO_4 and H_2O_2/PO_4 have been calculated and plotted with time to show the kinetics decrease of O_2 and H_2O_2 after the bleaching process. Calculation for time are presented as Mean ± SEM

RESULTS

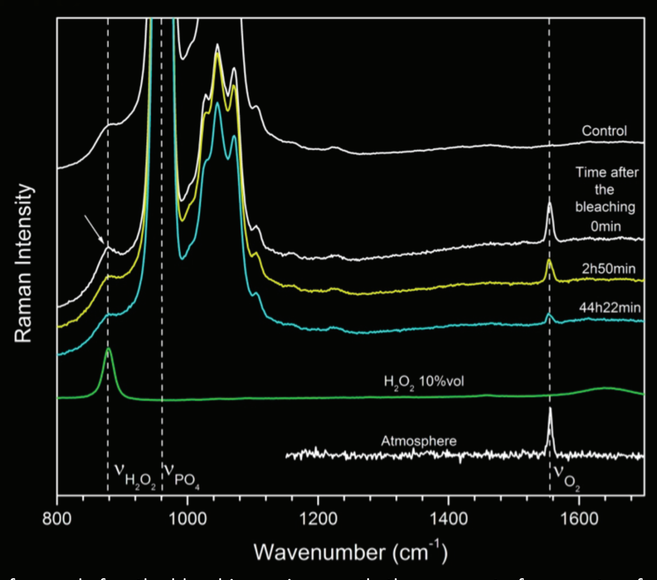

Figure 1 - Spectra before and after the bleaching, using exactly the same set of parameters for all the measurements. For each spectrum of enamel on the graph, the delay between the end of the bleaching process and the start of the measurement is specified. Spectra of atmosphere and 10% H_2O_2 solution are also presented.

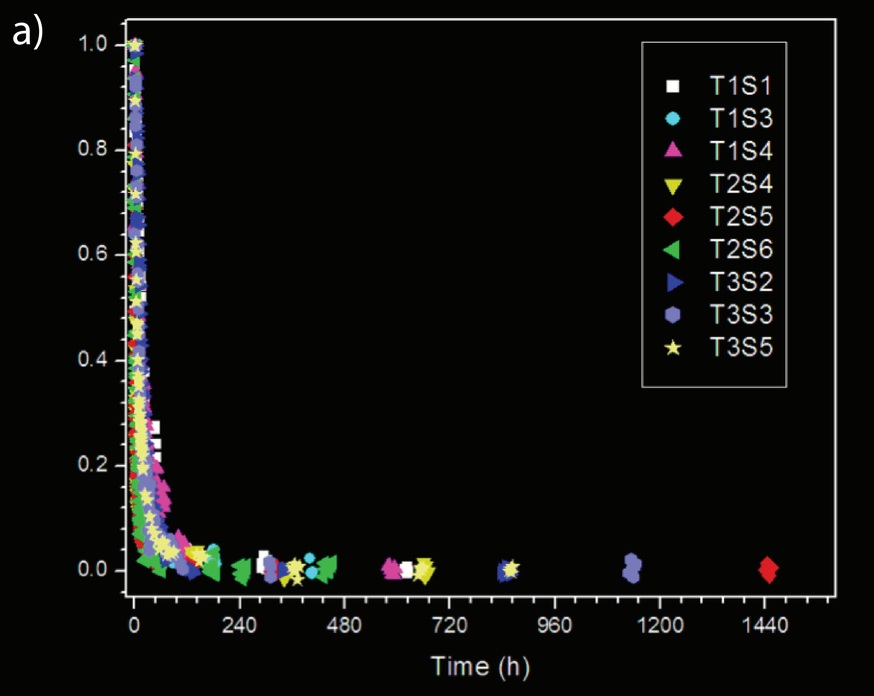

Figure 2 - Evolution of the ratio I_{O2}/IP_{O4} with time for the 9 samples, each curve has been divided by its maximum: a) In the range 0-1400h; b) Magnification in the range 0-3h

	I_{O2}/I_{PO4}			I_{H2O2}/I_{PO4}		
Sample \ ratio	$t_{1/2}$ (h)	$t_{1/10}$ (h)	$t_{1/100}$ (h)	$t_{1/2}$ (h)	$t_{1/10}$ (h)	$t_{1/100}$ (h)
T1S1	14.3	43.2	84.5	0.473	4.295	10.463
T1S3	2.0	16.4	51.2	0.933	6.813	18.715
T1S4	8.3	72.8	195.1	0.750	5.616	20.369
T2S4	1.2	10.1	47.8	0.258	3.289	11.782
T2S5	1.1	11.9	37.7	0.152	2.025	5.621
T2S6	3.2	17.5	65.6	0.212	2.846	6.824
T3S2	11.5	46.2	146.8	0.571	3.304	20.693
T3S3	7.8	42.4	153.3	0.621	4.344	14.829
T3S5	4.1	34.5	86.1	0.674	8.157	23.075
average	5.9 ±1.6	32.8 ± 6.9	96.4 ± 18.5	0.5 ± 0.09	4.5 ± 0.66	14.7 ± 2.1

Table 1 - Characteristic times (given in hours) for which the ratios I_{O2}/I_{PO4} and I_{H2O2}/I_{PO4} have been respectively divided by 2, 10 and 100 for each sample, the average ± SEM for each characteristic times is also presented.

DISCUSSION

- Performing a magnification of the curves I_{O2}/I_{PO4} in the range 0-3hours, there is an increase in the relative amount of O_2, problably generated by residual H_2O_2 in enamel subsisting in enamel after tooth bleaching.
- H_2O_2 disapear from enamel surface/subsurface much faster than O_2.
- This reduction is aproximadetly 10 times faster for H_2O_2 and after 14.7 hours only 1% of its relative amount was present while it took 4 days with O_2.
- The study of O_2 and H_2O_2 effects in Bis-GMA and TEGMA based adhesives efficacy is advisable and require further research.

CONCLUSIONS

Hydrogen Peroxide has a faster decrease in enamel surface when compared to oxygen. Oxygen continued to be generated in enamel surface for a few time after the removal of bleaching gel

REFERENCES

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