Effect of Carbamide Peroxide Concentration on Bleaching Efficacy

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ABSTRACT

Dentist-prescribed, home-applied bleaching products often use a concentration of 10% carbamide peroxide (CP). However, little data is available concerning the effectiveness of lower CP concentrations. This in vitro study explored the impact of varying concentrations of CP ranging from 0.4% to 10 % on bleaching efficacy. The color of thirty non-restored, caries free, extracted teeth were measured at baseline using a digital camera (Fuji HC-1000) and a re-positioning jig. Teeth were randomly distributed into six treatment groups (0%, 0.4%, 1%, 2%, 4% and 10% CP). Treatments were applied as a thin film of ~ 0.2g of gel (CP or placebo) to one side of the tooth and incubated in a sealed chamber at 32° C and 87% relative humidity for 2 hours. The teeth received 3 two-hour bleaching treatments per day for a total of 9 days. The CP gel was removed by brushing with tepid water between treatments and the teeth were stored in water overnight. Tooth color measurements were taken daily following the overnight re-hydration period. After 54 hours of exposure to the CP gels, the total changes in tooth color, as represented by ΔE*, were: 1.89(0%CP), 2.06(0.4% CP), 2.90(1%CP), 4.41(2% CP), 6.20 (4% CP) and 8.9 (10%CP). **Gels containing CP concentrations < 1% failed to provide any significant change in tooth color in vitro vs. placebo (α = 0.10). Concentrations ≥ 1% CP provided significant but substantially smaller color changes than did the 10% CP gel.**

MATERIALS AND METHODS

Extracted human molars were selected which were intact, free from caries, traumatic lesions, or disease. Soft tissue and bone were removed from the teeth by hand instrumentation, and teeth were polished with a rotary dental cup and pumice. The root portion of each tooth was then painted with clear fingernail lacquer. Once teeth were cleaned, polished, enameled, and dry, they were resin mounted in repositioning blocks. These blocks allow reproducible mounting of specimens for digital imaging. Labeled specimens were placed in ultra pure water to hydrate for at least 8 hours. After hydration of specimens, baseline L*, a*, and b* values were obtained and teeth were randomly assigned to groups. Criteria for selection of teeth were L* values of ≤ 72.

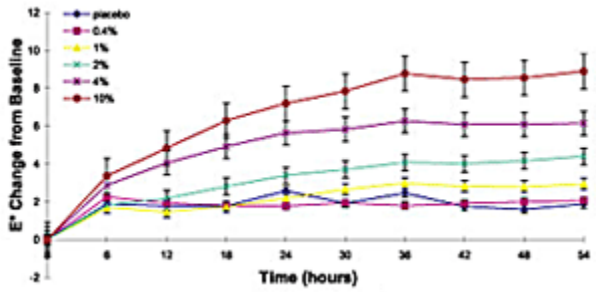
Treatment of specimens involved application of the treatment gel to a flexible plastic strip, which was then positioned on the tooth surface. Treatment gels contained 0% (placebo), 0.4%, 1%, 2%, 4% and 10% CP. N = 5 teeth for each treatment group. Specimens with treatments applied were placed in a humidifying incubator at 32°C and 87% humidity. Gel applications remained on teeth for two (2) hours. After each two-hour treatment period, specimens were removed from the incubator, strips were removed and gels were brushed from the teeth using a Crest Complete toothbrush and lukewarm tap water. Specimens received 6 hours of gel application (three 2 hour applications) and were then hydrated for at least 8 hours prior to digital imaging. A digital image was captured for each specimen immediately after removing it from hydration and placing it on the imaging jig. Digital images were collected at each time point and L*, a* and b* values were determined by image analysis. ΔL* (brightness), Δb* (yellow-blue), and ΔE* (overall change in 3-D color space) values are reported. Δs represent changes from the baseline values.

OBJECTIVE

This study compared the relative tooth-whitening efficacy of low-level (≤10%) carbamide peroxide gels.

RESULTS

Figure 1. Carbamide Peroxide Gel Dose Response in Extracted Molars



Mean Change from Baseline after 54 Hours Treatment				
	L*	a*	b*	ΔE*
Placebo	-0.1	1.118	-0.389	1.89A
±	1.51	0.18	1.04	0.85
0.4%	0.13	0.582	-1.725	2.06A
±	0.85	0.18	0.78	0.48
1%	2.15	0.04	-1.875	2.9B
±	0.70	0.39	0.59	0.59
2%	2.92	-0.565	-2.834	4.41C
±	1.13	0.25	1.31	0.32
4%	3.6	-1.368	-4.725	6.2D
±	0.98	0.52	0.54	0.76
10%	6.37	-2.053	-5.731	8.9E
±	0.93	0.52	1.01	0.64

CONCLUSION

-The CP gels provided a concentration dependent change in tooth color. L* increased, while a* and b* decreased with increased concentration of CP.

-Concentrations of ≥ 1% CP provided significant ΔE* changes versus the placebo.

-The tooth whitening effectiveness of the gels increased with increased CP concentration.

-A model of intrinsic tooth whitening efficacy was established using extracted molars screened for initial L*.

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