

# In-Use Kinetics of a 10% Hydrogen Peroxide Whitening Strip: Peroxide Degradation on Strips, Teeth, Gingiva and Saliva

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## ABSTRACT

**Objectives:** In vital bleaching, peroxide concentration and contact time contribute to effectiveness and safety. This research was conducted to establish the peroxide degradation profile of a thin layer 10% hydrogen peroxide bleaching gel delivered on a flexible polyethylene strip. **Methods:** 15 subjects participated in this study of Crest® Whitestrips® Premium, a thin layer of 10% hydrogen peroxide gel. Strip application was supervised. Strips were removed after 5, 10, 30 & 60 minutes. Samples were collected from the teeth, gingiva and saliva, and peroxide levels were derived immediately using an automated titration system.

**Results:** At 5 minutes, median peroxide concentrations were 7.3%, 6.4%, and 0.7% for strips, teeth, and gingiva, respectively, declining to 4.6%, 2.9%, and 0.1% at 30 minutes. Salivary samples never exceeded a median concentration of 0.014% at any time point. Samples differed significantly ( $p < 0.01$ ) with respect to the 30 & 60 minute area-under-the-curve calculations, with the highest concentrations on the strip and teeth, and the lowest on the gingival and in saliva. Median peroxide concentrations on strips and teeth remained above 2% over 60 minutes. At all post-treatment time points, gingival peroxide concentration was an order of magnitude lower than the teeth samples. **Conclusion: While use of a 10% hydrogen peroxide whitening strip results in appreciable peroxide on teeth over a 60 minute period, there was rapid peroxide degradation on the gingiva and very low accumulation in saliva anytime during use.**

## INTRODUCTION

In vital tooth bleaching, peroxide concentration and contact time contribute to both effectiveness and safety. This study was conducted to establish the peroxide degradation profile of new Crest Whitestrips (CWS) Premium, a thin layer 10% hydrogen peroxide bleaching gel delivered on a flexible polyethylene strip. CWS Premium is the new, one week, retail CWS kit launched in the US and Canada in Jan. 2004.

## MATERIALS AND METHODS

**Test Product:** Crest® Whitestrips® Premium  
- a polyethylene film with a peroxide gel (10% HP)

### Study Design

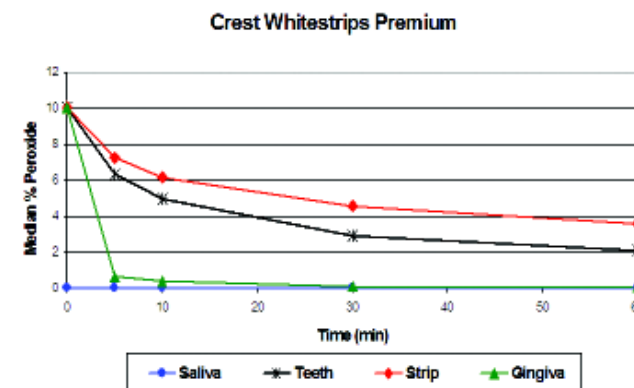
This was a supervised, one product, four day study. HP levels were measured on the strip, on teeth, in saliva, and on gingiva. Each subject, of the 15, completed a single dosing-time point/day, for four time points. The sampling times were 5, 10, 30, & 60 minutes. Recommended instructions for use of CWS Premium is 30 min., twice a day, for seven days.

### Sample Analysis

At the appropriate time point, a saliva sample was collected. Then the strip was removed and sampled for analysis. Next a sample of the residual gel was scraped from the anterior maxillary teeth. Finally, a swab was used to sample residual gel over the soft tissue of the papilla and along the gum line of the upper arch. Acid was added immediately to each sample. The samples were analyzed using a PeroXOquant Quantitative Peroxide Assay (Pierce), which is an indirect colorimetric analysis. Initial strip HP concentrations were analyzed using an indirect iodometric titration. Peroxide concentrations were compared statistically between strips, teeth, gingiva, and saliva by calculating subject-level differences between regions and then performing the non-parametric sign test.

## RESULTS (Cont.)

- **Samples differed significantly** ( $p < 0.01$ ) with respect to area-under-the-curve calculations, with the highest concentrations on the strip and teeth, and the lowest on the gingiva and in saliva.
- Median peroxide concentrations on strips and teeth remained above 2% over 60 minutes.
- At all post-treatment time points, gingival peroxide concentration was an order of magnitude lower than the teeth samples.
- Salivary samples never exceeded a median concentration of 0.014% at any time point.



## RESULTS

**Median % Peroxide with Time and Area Under Curve (AUC)**

	AUC (% Peroxide*min)	0 (min)	5 (min)	10 (min)	30 (min)	60 (min)
<b>Strip</b>	301.75	10.1	7.25	6.20	4.60	3.60
<b>Teeth</b>	223.25		6.35	4.95	2.90	2.10
<b>Gingiva</b>	41.18		0.65	0.38	0.11	0.07
<b>Saliva</b>	0.41		0.009	0.014	0.004	0.002

## CONCLUSION

Use of a 10% hydrogen peroxide whitening strip resulted in appreciable peroxide on teeth over a 60 minute period. This research also confirms the rapid disappearance of hydrogen peroxide and minimal oral soft tissue and systemic exposure following use of 10% hydrogen peroxide (130 mg gel load) strips.