



An Analysis of the Neutralization Process of Hydrogen Peroxide Care Systems

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Introduction

A variety of hydrogen peroxide (H₂O₂) care systems are available on the market. Each system is known to have unique sets of ingredients, catalysts, and case designs. Can one assume that all care systems are essentially equal?

Additionally, with a growing number of practitioners prescribing H₂O₂ care systems and a growing number of patients using private label solutions, it is important to understand the differences between each unique system and their implications on lens care and the patient experience^{1,2}.

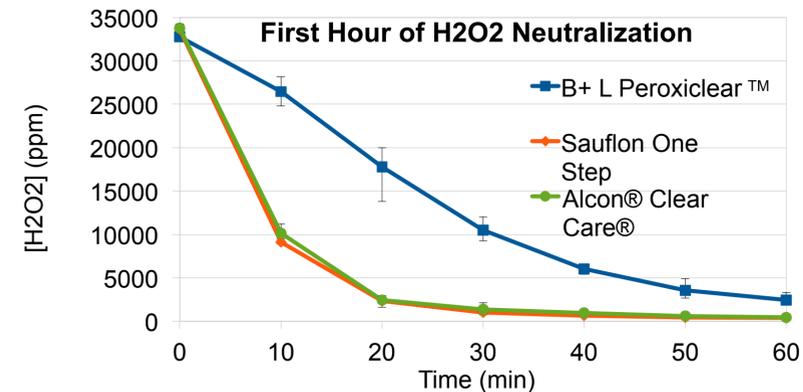
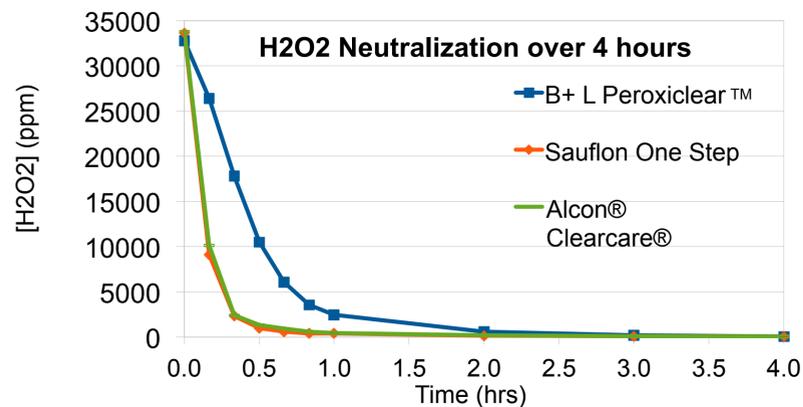
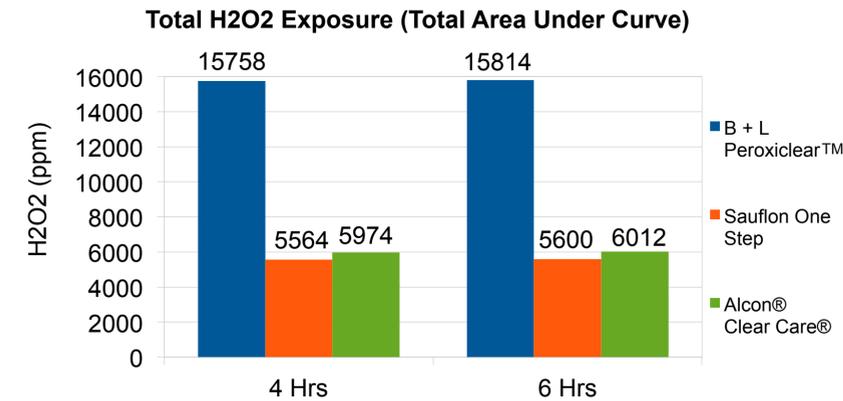
The latest innovation in H₂O₂ care systems has been the addition of platinum modulation compounds (PMC's) in B +L's newest care system, PeroxiClear™. PMC's interact with the platinum catalyst disc to slow the neutralization process and increase H₂O₂ concentration over the course of the neutralization process. The benefit is quick and effective anti-microbial action³.

To the author(s) knowledge, this is the first independent study comparing the H₂O₂ neutralization process of this unique set of one-step care systems.

Methods

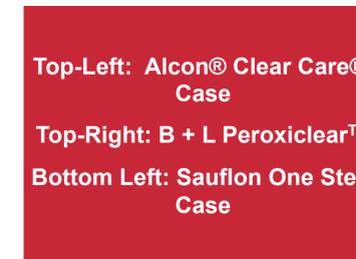
Investigators identified three hydrogen peroxide care systems that are readily available in the United States: B +L PeroxiClear™, Alcon® Clear Care®, and Sauflon One Step (commonly marketed as a private label care system). After confirming known delays in neutralization within the first 20 minutes of use with new platinum catalyst disks, investigators chose to use cases that had previously undergone one full 8-hour cycle of neutralization. 39 cases of each care system underwent the neutralization process for 8 hours with the corresponding hydrogen peroxide-based solutions. A total of 42 samples were taken for each care system over an 8-hour period; 3 unaltered samples of un-neutralized solution, 3 samples taken in ten-minute intervals over the first hour, and 3 that were taken every hour until eight hours. Altogether, a total of 126 samples were measured across three different case systems. At each interval, an assay was prepared using a sample of contact lens solution. The assay was then titrated with potassium permanganate. End points were determined by comparing against a pre-made distilled water blank. The concentration of peroxide was then calculated from the volume of permanganate solution used during the titration process.

Results



Alcon® Clear Care® and Sauflon One Step demonstrated similar H₂O₂ concentrations and neutralization rates ($p > .05$) over 8 hours. Whereas B +L PeroxiClear™ exhibited significantly higher H₂O₂ concentration ($p < .0001$) and a slower rate of neutralization, particularly over the course of the first hour. For both Alcon® Clear Care® and Sauflon One Step, there was a rapid decrease in H₂O₂ concentration over the first 30 minutes. They exhibited approximately a 70% (or a 24,000 ppm decrease) in hydrogen peroxide concentration within the first 10 minutes. There was another sharp decrease in concentration between the next two 10 minute intervals, 75% (7,000 ppm) and 50% (1,200 ppm) decreases respectively. In contrast, B +L PeroxiClear™ exhibited a 19 percent (6,300 ppm) decrease in the first 10 minutes, a 33 percent decrease between 10-20 minutes, then then maintained approximately a 38% (3,800ppm) decrease at 10 minute intervals between 20-60 minutes.

After four hours of neutralization, all care systems exhibited similar H₂O₂ concentrations ($p > .05$) and neutralization rates ($p > .05$). All care systems reached less than 100ppm by the 4th hour of neutralization. This is a level that is known to exhibit minimal damage to the ocular surface and is below the ocular awareness threshold⁴⁻⁵.



Top-Left: Alcon® Clear Care® Case

Top-Right: B + L Peroxiclear™

Bottom Left: Sauflon One Step Case

Discussion & Conclusion

- **Platinum Modulating Compounds, specifically carbamide, along with its catalyst disc design is effective at decreasing the rate of H₂O₂ neutralization and increasing overall peroxide exposure over the course of the first 4 hours of neutralization.** Although the authors did not explicitly test anti-microbial efficacy, one might infer that increased H₂O₂ exposure would lead to increased anti-microbial efficacy- a known concern for many eye care practitioners in 2014¹.
- **For all three care systems, H₂O₂ concentration was at a “safe” and “comfortable” level (<100 ppm) for contact insertion at 4 hours³⁻⁴.** The additional level of hydrogen peroxide exposure between hours 4-8 was minimal (36-56ppm). Although B + L PeroxiClear™ has demonstrated disinfection efficacy at four hours, Alcon® Clear Care® and Sauflon One Step clearly instructs users to undergo a 6 hour neutralization process. Therefore, the authors do not recommend a shortened neutralization with these products even though contact lens insertion would not be uncomfortable and the hydrogen peroxide concentration would not damage the ocular surface.
- **Case design can affect the disinfection process if the patient is not informed on its use.** Because the platinum catalyst disc of the Sauflon One Step care system is located on the bottom of the case, neutralization will begin to occur as soon as the case is filled with H₂O₂ solution as opposed to other systems in which the lens holders and platinum catalyst disc are submersed in the H₂O₂ solution at the same time. It is known that Sauflon One Step dramatically decreases in H₂O₂ concentration within the first 10 minutes. Therefore, if patients begin the neutralization process prematurely, their lenses may not be exposed to optimal levels of hydrogen peroxide.

References

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