

Does the pH of Scleral Lens Filling Solutions Affect Comfort in Dry Eye Patients?

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Introduction

Patients with corneal and ocular surface disease rely on scleral lenses to help improve vision and help manage their symptoms of irritation, itching, and redness. An important part of the scleral lens system is the fluid that is used to fill the lenses before application since that fluid will be interacting with the ocular surface all day. While many practitioners have found that some patients do better with certain formulations, the effect of pH of filling solutions has never been studied.

The purpose of this pilot study is to assess whether the pH of scleral lens filling solutions affect subjective comfort in patients with dry eyes. Sterile saline filling solutions come in buffered and non-buffered formulations with a range in pH. The range of pH for human tears in normal eyes is from 6.5-7.6.¹ However, studies have found that the tear pH of dry eye patients tends to be more alkaline than normal patients.² Due to this phenomenon, non-buffered filling solutions which tend to be more acidic, may exacerbate symptoms for dry eye patients due to the difference in pH of the saline solution and the natural tear.

Material and Methods

The pH of common sterile 0.9% NaCl scleral filling solutions were measured with an Apera pH meter 3 times using different vials or bottles. The instrument was calibrated before measurements were taken and was cleaned and dried between each measurement.

Six healthy subjects between 20-42 years of age were included in the study. Subjects must have had symptomatic dry eye and were using no treatments other than artificial tears. They were evaluated for ocular surface disease through slit lamp examination with fluorescein staining, Lissamine green staining, and Schirmer test.



Figure 1: Picture of the Apera pH meter used in this study

At the start of the pilot study, all subjects were asked to fill out the Texas Eye Research and Technology Dry Eye Questionnaire (DEQ). All subjects (12 eyes) were then fitted with the Art Optical Ampleye scleral lenses with a 15.5 diameter. The aim upon fitting was to get an initial central clearance of 300 microns. Half the subjects filled their scleral lenses with buffered filling solution (ScleralFil) for the first two weeks, the other half filled their lenses with non-buffered saline solution (Addipak) first. The order of solutions was randomly assigned. After 2 weeks of lens wear, the subjects were asked to fill out the DEQ again and the dry eye evaluation was redone. The subject would then switch filling solutions. At the end of 4 weeks, the DEQ and the dry eye evaluation was repeated once more and subjects were asked to compare the filling solutions. Subjects were not informed about the difference between the two solutions but were asked to evaluate comfort on initial application and end of day comfort. Subjects were asked to wear the lenses for at least 10 hours a day and to only clean and store lenses in Unique pH.

Results

The pH measured by the Apera pH meter was consistent with whether the solution was buffered. Buffered solutions had pH measurements around that of the natural tear pH, while solutions that were not buffered had lower pH measurements which ranged from 5.33-6.45.

For the objective measurements of ocular surface disease, the only test that showed statistical significance between the two solutions was the Schirmer testing. However, Schirmer testing was reduced from baseline after scleral lens wear. Fluorescein staining and Lissamine green staining showed no statistical significance between baseline and after either filling solution



Figure 2-3: Picture of common 0.9% NaCl sterile saline solutions used to fill scleral lenses and a table showing their pH values

The results of the dry eye questionnaire showed a significant improvement in symptoms dry eye with scleral lens wear regardless of solution used. However, mean score on questionnaire was statistically better with the buffered solution compared to the non-buffered solution. (p<0.05)

When asked which filling solution they preferred at the end of the four week study, five out of six subjects said they preferred the buffered filling solution. The last subject did not notice any difference between the two solutions. Two subjects noticed a difference upon application of the lens, stating that the buffered filling solution did not sting, while the non-buffered did. Four subjects reported better end of day comfort with the buffered filling solution. All subjects in the study reported that they would continue scleral lens wear to help manage their dry eye symptoms.

Conclusion/Discussion

Though our sample size is small, our study shows that patients with dry eye prefer filling scleral lenses with a buffered filling solution vs. a non-buffered one. This may be due to the large difference in pH between a non-buffered solution and that of the natural tear. If patients are experiencing discomfort with scleral lenses that are fitting well, changing the filling solution is something that should be considered. More research needs to be done to evaluate the effect of pH of filling solutions on normal eyes as well as eyes with other corneal diseases/degenerations.

Acknowledgments

Thank you to Art Optical for providing the scleral lenses for this study.

References

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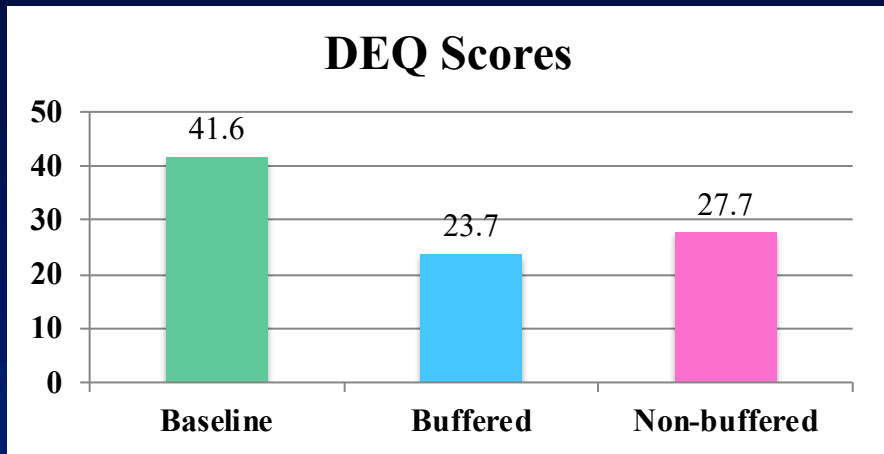


Figure 4: Graph showing the DEQ scores at baseline, after using the buffered filling solution for 2 weeks and after using the non-buffered solution for 2 weeks