

SOLUTION INDUCED CORNEAL STAINING: EVOLVING OUR UNDERSTANDING OF SICS

Key milestones on the way to reaching current thinking

2002

First reports of solution-related staining associated with silicone hydrogel lenses^{1,2}

Maximal staining typically observed after 2 hours lens wear.³

Staining matrices developed^{4,5}

Wide variation in staining response driven by combination of lens material and care solution used.

Debate: contact lens comfort

Range of results found for impact of SICS on contact lens comfort, from asymptomatic,^{1,2,6} through to mild,^{3,5,7} and moderate symptoms.^{8,9}

Debate: mechanism of staining

Previous work implicated the preservative in MPS, especially PHMB.^{4,5,10} Initial reports suggested PHMB associating with the cell surface led to hyperfluorescence.¹¹ Further work established fluorescein is taken up into cells rather than simply pooling between damaged cells as previously thought.¹²⁻¹⁵

Cause – preservative or surfactant?

Demonstrated that uptake of fluorescein into the cell is through a dynamin-dependant pathway mediated by a specific surfactant, Tetronic 1107.¹⁶ Thus, Tetronic 1107 found in some MPS, may play a role in SICS.

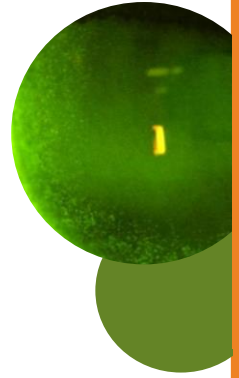
Significance?

Though not all in vitro work demonstrated cell damage,¹⁶ SICS is still considered an undesirable response.^{17,18}

Now

Applying this knowledge in practice

- Some material-MPS combinations may produce SICS.
- Pay attention to the surfactant rather than the preservative present in the MPS.
- If SICS occurs, consider changing the material-MPS pairing to reduce potential clinically significant changes to epithelial cells.



1. Epstein, A.B., SPK with daily wear of silicone hydrogel lenses and MPS. *Cont Lens Spectr*, 2002, 17(11): p. 30 2. Jones, L., N. Macdougall, and L.G. Sorbara, Asymptomatic corneal staining associated with the use of balaflacon silicone-hydrogel contact lenses disinfected with a polyaminopropyl biguanide-preserved care regimen. *Optom Vis Sci*, 2002, 79(12): p. 753-761. 3. Garofalo R. et al. Corneal staining and subjective symptoms with multipurpose solutions as a function of time. *Eye Contact Lens*. 2005;31:166-74 4. Carnt, N., et al., IER Matrix Update: Adding Another Silicone Hydrogel Contact Lens Spectr, 2008 (March) 5. Andrasko, G. and K. Ryan, Corneal staining and comfort observed with traditional and silicone hydrogel lenses and multipurpose solution combinations. *Optometry*, 2008, 79(8): p. 444-454 6. Malet, F. An acute clinical comparison of corneal staining and comfort associated with contact lens care solutions. *Cont Lens Anterior Eye*, 2014, 37:351 7. Woods J and Jones L. Pilot study to determine the effect of lens and eye rinsing on solution-induced corneal staining (SICS). *Optom Vis Sci*. 2016;93:1218-27 8. Lazon de la Jara, P et al., et al. Effect of lens care systems on the clinical performance of a contact lens. *Optom Vis Sci*. 2013;90:344-50 9. Diez J, et al. Comparison of ocular comfort, vision, and SICS during silicone hydrogel contact lens daily wear. *Eye Contact Lens*. 2012;38:2-6 10. Pritchard, N. et al. Subjective and objective measures of corneal staining related to multipurpose care solutions. *Cont Lens Anterior Eye*. 2003;26:3-9 11. Bright, F., et al. A preservative-and-fluorescein interaction model for benign multipurpose solution-associated transient corneal hyperfluorescence. *Cornea*. 2012; 31(12) 1480-88 12. Bandamwar, K., et al. Mechanisms of superficial micropunctate corneal staining with sodium fluorescein: the contribution of pooling. *Cont Lens Anterior Eye*. 2012;35:81-4 13. Bandamwar, K. et al. Fluorescein staining and physiological state of corneal epithelial cells. *Cont Lens Anterior Eye*. 2014;37(3):213-23 14. Bakkar, M. et al. The cellular basis for biocide-induced fluorescein hyperfluorescence in mammalian cell culture. *PloS ONE*. 2014;9(1):e84427 15. Gorbet, M., et al. Human corneal epithelial cell shedding and fluorescein staining in response to silicone hydrogel lenses and contact lens disinfecting solutions. *Curr Eye Res*. 2014;39:245-56 16. Khan, T. et al. Cellular hyperfluorescence is dynamin-dependent and increased by tetronic 1107 treatment. *Int J of Biochem & cell biology*. 2018;101:54-63 17. Bandamwar, K., et al. Sodium fluorescein staining of the corneal epithelium: what does it mean at a cellular level. *Cont Lens Anterior Eye*. 2011;34:519 18. Gorbet M, Postnikoff C. The impact of silicone hydrogel-solution combinations on corneal epithelial cells. *Eye Contact Lens*. 2013;39:42-7.