Title

Solute-Uptake Characterization of Water-Gradient Laminated Soft Contact Lenses

Journal

INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE, 55(13)

ISSN

0146-0404

Authors

Liu, David E

Dursch, Thomas J

Oh, Yoobin

et al.

Publication Date

2014-04-01

Peer reviewed

FREE
ARVO Annual Meeting Abstract | April 2014

Solute-Uptake Characterization of Water-Gradient Laminated Soft Contact Lenses

David E. Liu; Thomas J. Dursch; Yoobin Oh; Clayton J Radke

+ Author Affiliations & Notes

Investigative Ophthalmology & Visual Science April 2014, Vol.55, 6071. doi:

Abstract

Purpose

Silicone-hydrogel (SiHy) Dailies Total1® lenses have recently been introduced to improve comfort with a soft surface-gel coating of water content greater than 80% laminating a 33% water content SiHy core (Pruitt, J.; Bauman, E. Contact Lens Spectrum. 2013). All else being equal, higher water content, reflective of larger water-filled pores, leads to greater solute partitioning into soft contact lenses (SCLs) . To ascertain the laminated structure of Dailies Total1® lenses, we investigate the spatial dependence of solute uptake by Fluorescence Confocal Laser Scanning Microscopy (FCLSM). Solute loading properties of a single-water-content SiHy SCL (Air Optix® with a 33 % water content) were measured for comparison.

Methods

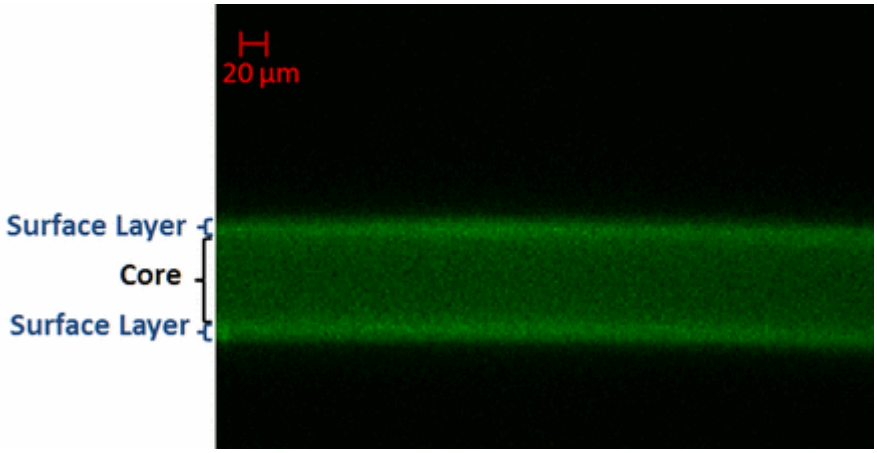
After equilibration, in-lens uptake of FITC-dextrans of 4,20 and 70 kDa MW were measured in Dailies Total1®, and Air Optix® SCLs by FCLSM. Partition coefficients were subsequently calculated. The local water content of the surface-gel layer was determined by applying Enhancement-Factor Partitioning-Theory (EFPT) (Dursch, T.J. et al. Biomaterials. 2014).

Results

Fig. 1 depicts a typical micrograph of FITC-dextran 4kDa MW equilibrium loading in a Dailies Total1® SCL. Uptake into the surface-gel layer is clearly greater than that in the SiHy core. Through image analysis, the surface-gel layer was determined to be ~10±5μm. Fig. 2 displays local partition coefficients as a function of solute size (i.e., hydrodynamic radius). Partition coefficients decrease with increasing solute size for each material, with loading in the Dailies Total1® surface layer ~2 times that of the core. As expected, uptake in the Dailies Total1® core is comparable to that in Air Optix® due to their similar composition and water content. Application of EFPT yielded a surface-gel layer water content of 91±4%.

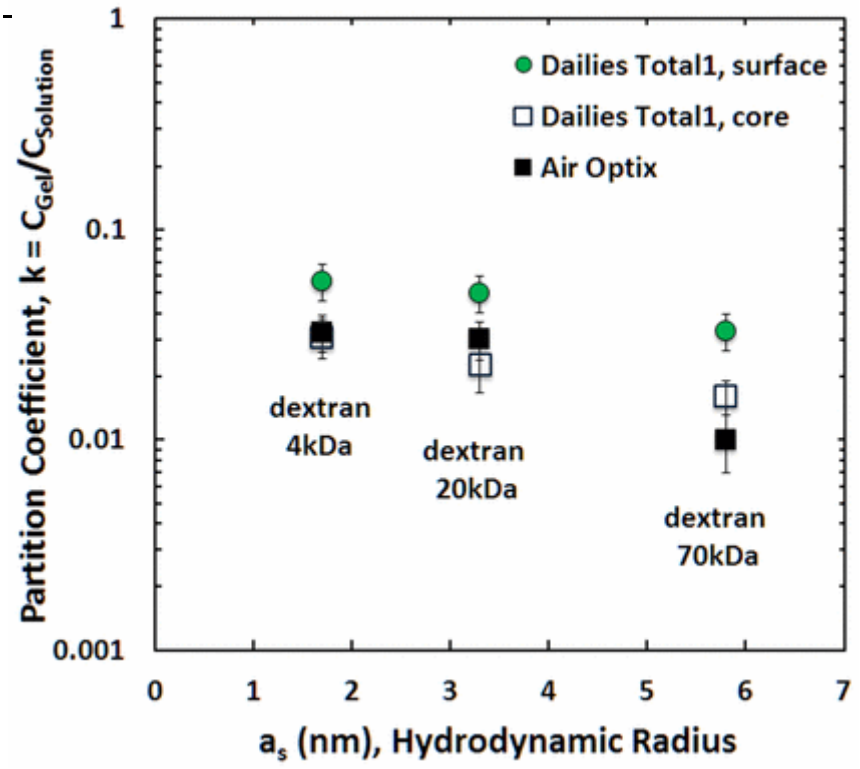
Conclusions

Solute uptake measurement establishes the structure of the surface-gel layer of Dailies Total1® lenses with consistently greater solute partitioning in the surface-gel layer than in the SiHy core. Water-gradient contact-lens characterization is successful via FCLSM confirming the laminated structure of Dailies Total1® with surface-gel-layer thickness (~10±5μm) and water content (91±4%).



View Original Download Slide

Fig. 1: Fluorescence micrograph of FITC-dextran 4kDa MW loading in Dailies Total1®.



View Original Download Slide

Fig. 2: Local FITC-dextran partition coefficients in the Dailies Total1® surface layer and core, and Air Optix® as a function of solute size.