Deposition of fluorescently tagged lysozyme on contact lenses in a physiological blink model

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Introduction

- 25% of contact lens (CL) wearers dropout due to discomfort.[1]
- Protein deposits remain one of the potential suspects as the underlying cause of this discomfort.[2-4]
- These deposits can alter the physical and functional properties of the CL, and consequently alter wettability, visual acuity, and tear physiology.[2-4]
- Lysozyme is a major tear film protein and has often been used as the representative protein in in vitro CL deposition studies.
- However, there is limited literature on lysozyme deposition studied under a physiologically relevant eye model that is able to simulate the pre-lens and post-lens tear film.

Purpose

- To visualize the deposition of fluorescein isothiocyanate (FITC)-lysozyme on daily disposable CLs using a novel blink model.

Methods

- 6 daily disposable CL were used:
  - Conventional hydrogel: etafilcon A, nelfilcon A, omafilcon A
  - Silicone hydrogel: senofilcon A, delefilcon A, somofilcon A
- CLs were mounted onto a novel blink model (Figure 1) and exposed to an artificial tear solution containing FITC-labelled lysozyme for 2 and 10 hours.
- The flow rate and blink speed were set to 1 μL/min and 6 blinks/min.
- After the incubation period, a 5 mm diameter disc was punched out from the center of the lens and mounted on a microscope slide.
- The slides were imaged using the Zeiss 510 Meta confocal laser scanning microscope, which scanned the lens from the front to the back surface at 1 μm increments.

Figure 1. In vitro eye model showing the **A** eyeball, **B** eyelid, **C** tubing, **D** motor and **E** casing.

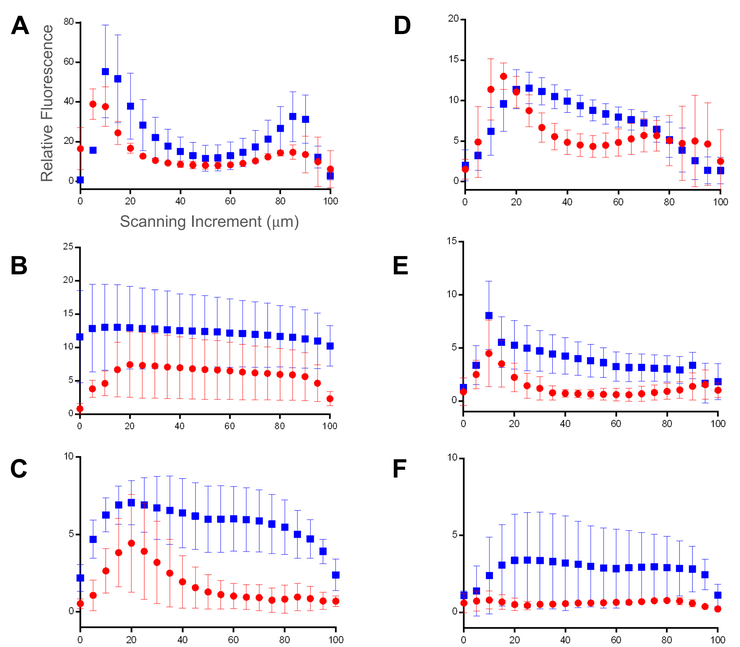

Figure 2. Histogram for FITC-lysozyme deposition at 2 hours (●) and 10 hours (■) for conventional hydrogels (**A** etafilcon A, **B** nelfilcon A, **C** omafilcon A) and silicone hydrogels (**D** senofilcon A, **E** delefilcon A, **F** somofilcon A)

Results

- Conventional hydrogels deposited higher amounts of FITC-lysozyme than silicone hydrogels ($p<0.001$).
- With increasing incubation time, there was an increase in deposition of FITC-lysozyme for all lens types ($p<0.05$), with the exception of somofilcon A, which did not show statistical significance between 2 and 10 hours ($p<0.001$).
- Etafilcon A deposited the highest amount of FITC-lysozyme ($p<0.05$).
- At the 2 hour incubation time, most CLs showed a higher amount of deposition at the front surface than the back surface of the lens, particularly for etafilcon A which showed a preferred front surface deposition at all time points.

Conclusions

- The results suggest that there is differential deposition at the front surface of the CL (which is exposed to the pre-lens tear film) compared to the back surface of the CL (which is exposed to the post-lens tear film).
- It may be beneficial to design CL materials with differing surface properties for the front and back surfaces of the CL to enhance interactions with the tear film and ocular surface.

References

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