“Light Transmittance of Cadaver-Eye Explanted Single-Piece Hydrophobic Acrylic IOLs With Surface Light Scattering”

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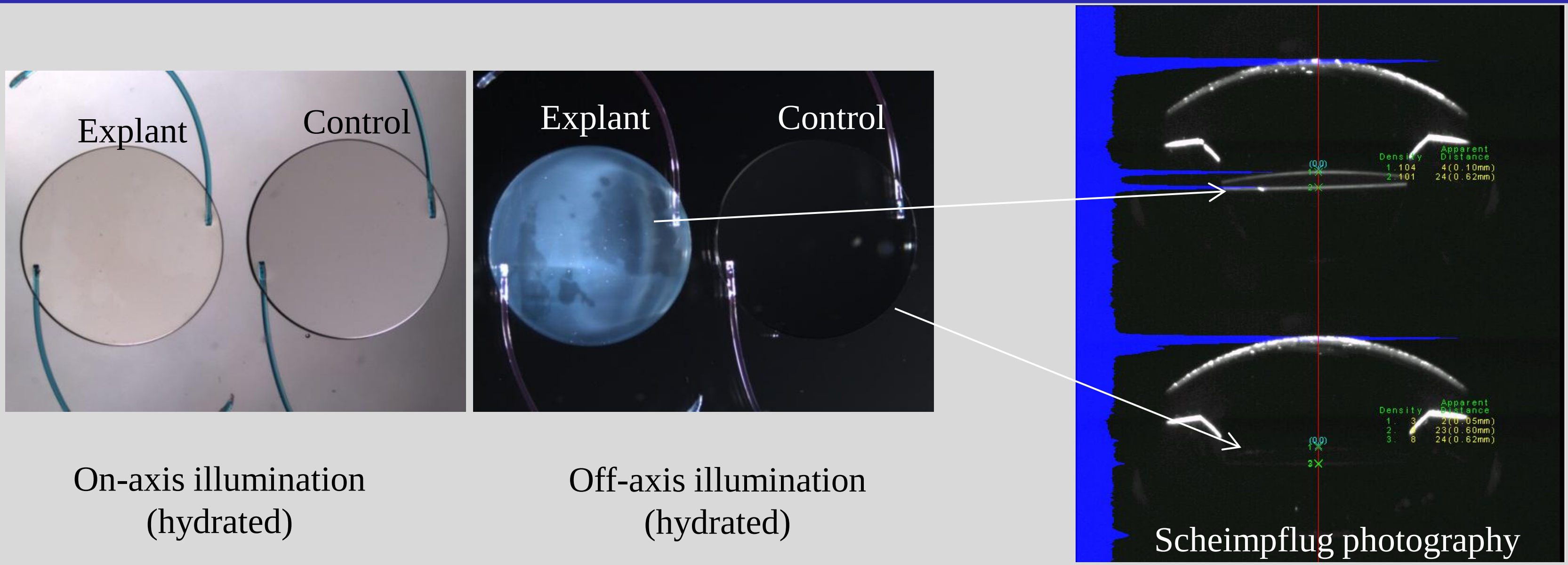
Background

Surface light scattering of intraocular lenses (IOLs) is related to subsurface **nanoglistenings**, becoming notable only under oblique light (off-axis) conditions at an incidence angle of 30° or greater during slit lamp examination, or during image capture at an angle of 45° with Scheimpflug photography. Scattering is caused by phase separation of water (from aqueous humor) as subsurface nanoglistenings.[1-5]



On-axis illumination (hydrated)

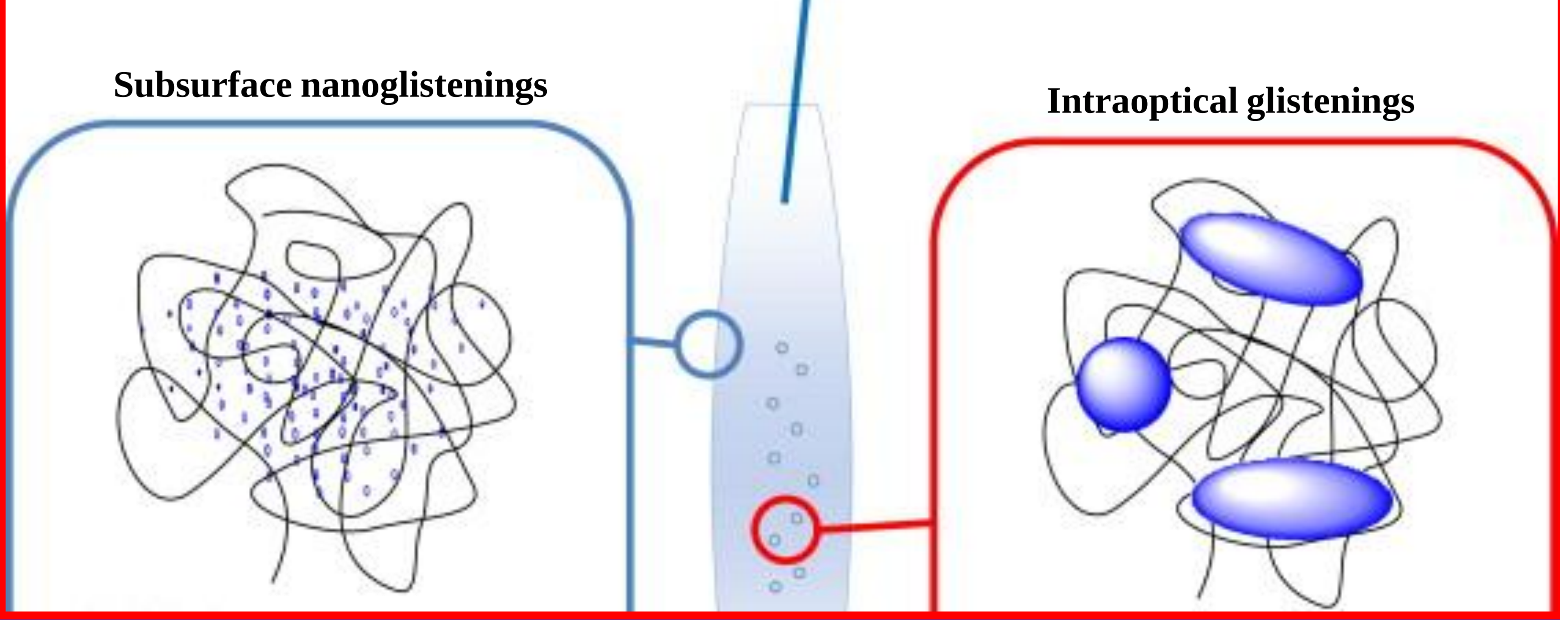
Off-axis illumination (hydrated)

Scheimpflug photography

Objective

- ***The aim of this study was to investigate the potential effect of surface light scattering (related to subsurface nanoglistenings) on the light transmittance of single-piece hydrophobic acrylic AcrySof IOLs (Alcon) with or without blue light filter (BLF).[6]***
- **We do not assess the effect of scattering related to glistenings, which are fluid-filled microvacuoles within the IOL optic.**

From Matsushima H, et al. *J Cataract Refract Surg* 2009; 35:1927-34.[2]



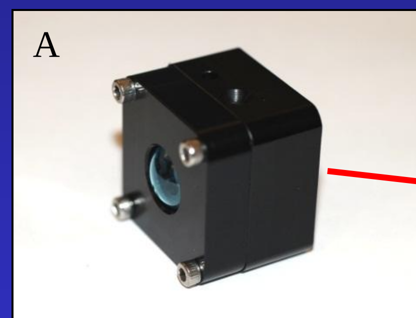
Materials and Methods

- IOLs were obtained from human cadavers (49 lenses total; 36 with BLF). Implantation time was 3.80 +/- 3.26 years in the BLF group and 4.38 +/- 3.12 years in the non BLF.
- The IOLs were explanted from the cadaver eyes and power/model matched to unused controls from finished-goods inventory.
- Explanted lenses with control IOLs were fixed in 10% neutral buffered formalin for 1 hour.
- Proteins on all IOLs were stained with Coomassie blue G-250 dye and enzymatically removed.
- Bright-field and dark-field images were captured for all lenses, before and after hydration. Dark-field images were obtained with a 90-degree off-axis illumination.

Materials and Methods

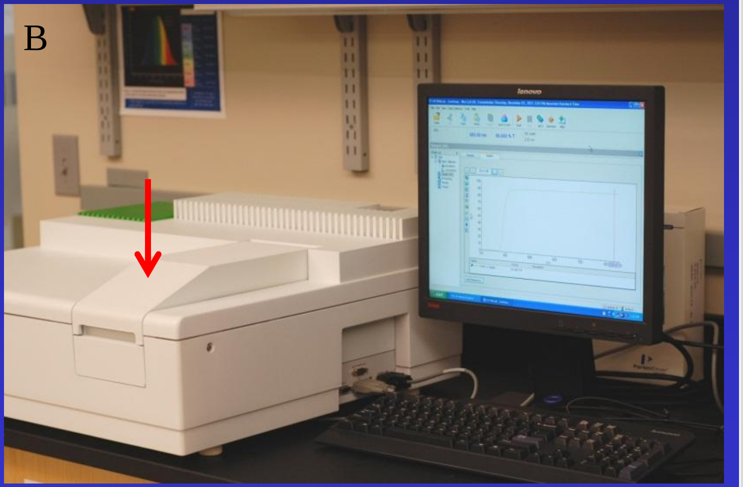
- Surface light scattering was then measured with a Scheimpflug camera (EAS-1000 Anterior Segment Analysis System, Nidek Ltd) with the following settings: flash level 200 W; slit length 10 mm; meridian angle 0. Results were expressed in CCT (measure of brightness).[4-6]

Light scattering measurements.
A: Gross photograph of the customized dark eye model used to hold the IOL under immersion in BSS (Alcon). The PMMA cornea is shown on the left; the model is filled with BSS through the holes on top.
B: Photograph showing the Nidek EAS-1000 Scheimpflug camera. The eye model sits elevated on a metal bridge located on the chin rest (arrow).



Materials and Methods

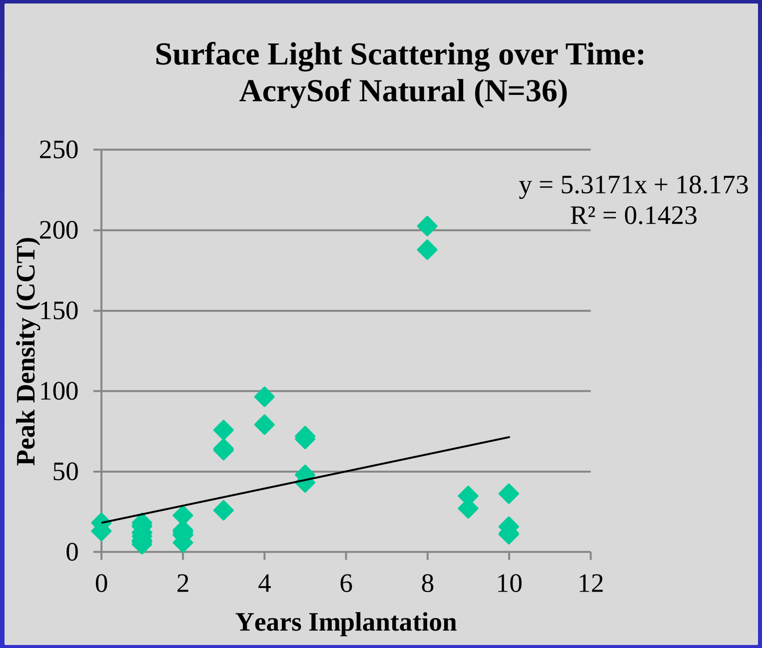
- Light transmittance was measured with a Perkin Elmer Lambda 35 UV/Vis spectrophotometer (single-beam configuration with RSA-PE-20 integrating sphere). Results were expressed as % light transmittance in the visible light spectrum (700-400 nm).[7]

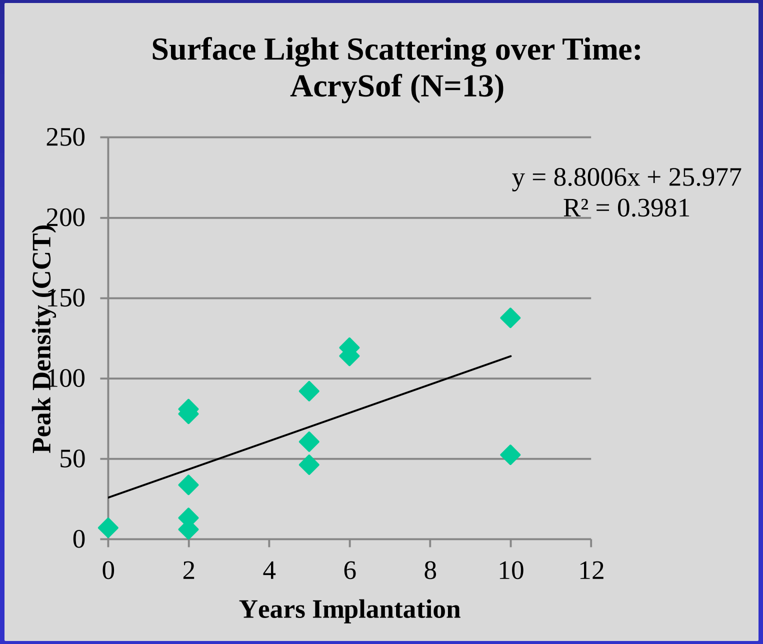


Light transmittance measurements.
A: Gross photograph of the cuvette containing the black plastic insert designed to hold the IOL in place under immersion in BSS.
B: Photograph showing the Lambda 35 UV/Vis spectrophotometer. The arrow indicates the chamber where the cuvette containing the IOL is placed for the measurements.

Results

- There was a tendency for increasing scatter values with increasing postoperative time for both groups (BLF lenses: r = 0.3772, P = 0.0226; non BLF lenses: r = 0.6310, P = 0.0188), consistent with clinical observations.[8,9]





Results

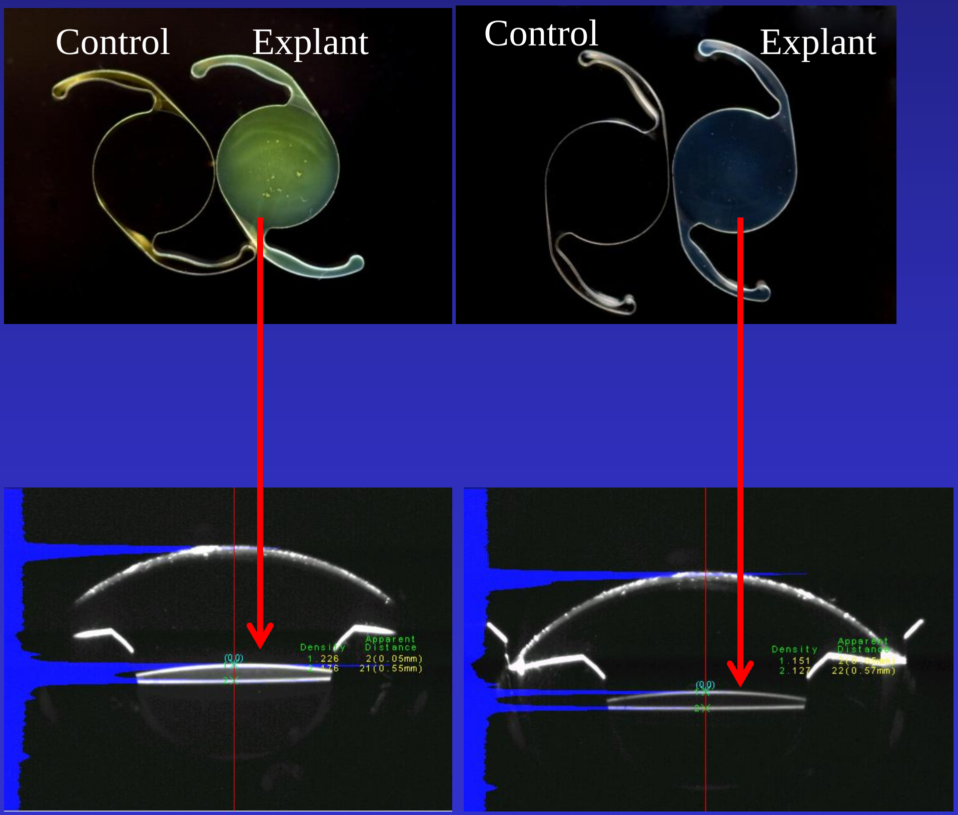
- Significant differences in CCT values were observed between explanted IOLs and controls for both groups of lenses (P<0.001, Paired T-Test).

Values for BLF lenses:

Explant Mean	38.4 +/- 46.1 CCT
Explant Range	4.8 to 202.5 CCT
Control Mean	5.4 +/- 2.3 CCT
Control Range	1.5 to 11.8 CCT

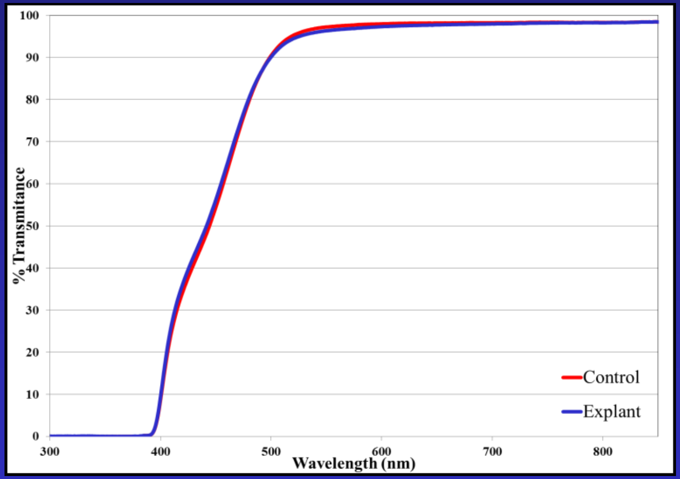
Values for non BLF lenses:

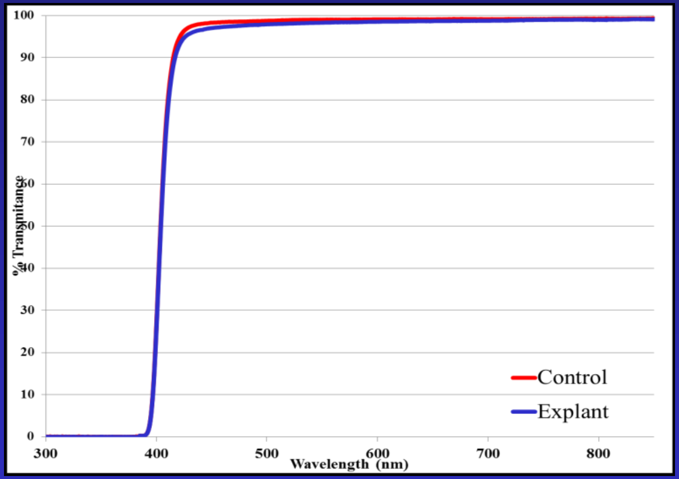
Explant Mean	64.6 +/- 43.6 CCT
Explant Range	6.0 to 137.5 CCT
Control Mean	6.1 +/- 1.8 CCT
Control Range	3.5 to 9.6 CCT



Results

- No differences in % light transmittance in the visible light spectrum were observed between explanted IOLs and controls for both groups of lenses.





Mean light transmittance in the visual spectrum* in BLF lenses:

Explant Mean	83.69 +/- 1.05 %
Control Mean	83.76 +/- 0.88 %
Paired T-Test	P=0.407

Mean light transmittance in the visual spectrum* non BLF lenses:

Explant Mean	95.91 +/- 0.66 %
Control Mean	96.02 +/- 0.75 %
Paired T-Test	P=0.487

700-400 nm

Discussion/Conclusions

- Previous studies measuring light scattering and light transmittance of AcrySof lenses in vitro mostly involved 3-piece designs made of ultraviolet-blocking material.[2-5]
- This is the first study using a significant number of single-piece lenses explanted from cadaver eyes with known implantation duration, especially with regards to the material with BLF (AcrySof Natural).[6]
- Protein deposits were removed prior to measurements to specifically assess the effect of subsurface nanoglistenings, independent of surface deposits.

Discussion/Conclusions

- In both groups of lenses (with or without BLF), light scattering of postmortem explanted lenses was significantly higher than that of matching controls. However, this was not associated with a significant decrease in light transmittance.

- ***In conclusion, although surface light scattering of cadaver-eye explanted lenses was significantly higher than that of controls and appeared to increase with time, no effect was observed on the light transmittance of single-piece hydrophobic acrylic lenses with or without blue light filter.***

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