Opacification of a Hydrophilic Acrylic Intraocular Lens

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ABSTRACT
Opacification of a hydrophilic acrylic intraocular (IOL) lens is a rare phenomenon. We herein report a case of a 57-year man complaining of decreased vision at left eye for the last 4 months. He had undergone phacoemulsification with IOL implantation 2 years back. IOL opacification was observed through slit-lamp. IOL exchange was carried out. The exchanged IOL and a new lens of the same model were sent to laboratory for pathologic analysis. Confocal microscopy showed uniformly distributed granules from the surface to 80 µm internal surface. Scanning electron microscopy (SEM) showed the details of granules. X-ray photoelectron spectroscopy (XPS) confirmed the presence of calcium and silicon in the deposits. Aqueous humor biochemical analysis revealed a normal result. We discuss the possible causes of opacification of IOL in this report.

Key Words: Intraocular lens opacification. Hydrophilic acrylic intraocular lens. Intraocular lens exchange.

INTRODUCTION
Cataract extraction and intraocular lens (IOL) implantation has been developed more than 60 years ago. However, the study of postoperative IOL opacification has been carried out only during recent past. The first case was reported by Jean Champbellin in 1991 of an opacified IOL made from PMMA material.1 Then, a series of reports on hydrophilic hydrogel and silicone gel artificial lenses appeared.2 Hydrophobic acrylic IOL opacification has also been reported in recent years.3,4 IOL opacification is a disorder that has led to significant visual decrease, and IOL exchange is the most appropriate treatment till today.

In this case report, we described a hydrophilic acrylic IOL's postoperative opacification. IOL exchange surgery was performed and the explanted IOL was sent to laboratory for further analysis.

CASE REPORT
A 57-year man was referred to our clinic, who had a history of glaucoma for more than 10 years and was otherwise healthy. Bilateral glaucoma operation was performed in 2005. The left eye's phacoemulsification was performed in April 2013. During the surgery, an Akreos Adapt Advanced Optics (AO) IOL, made from hydrophilic acrylic, was implanted into the capsular bag. Before surgery, the patient's best corrected visual acuity (BCVA) was 5/100 in left eye. On second day after surgery, his visual acuity improved to 5/32. Post-operative medication included tobradex eye drops, and ofloxacin 0.5% eyedrops, four times a day for 4 weeks. In July 2015, the patient complained of decreased visual acuity in the left eye for last 4 months. BCVA was HM/10cm in his left eye. Under the slit-lamp, significant opacification was located at IOL optical central area. The count of endothelial cells dropped to 527.8/mm²; however, in 2013, the counts were 2087.9/mm². IOL exchange was carried out and a hydrophobic acrylic IOL (Alcon, SA60AT) was implanted in the ciliary sulcus. The exchanged IOL was immediately placed in and preserved in the freezer (4°C), and then sent to laboratory for ophthalmic devices research and pathologic analysis. The same model was also sent to laboratory as a control for examination. Aqueous humor was also collected and the components were measured by automatic biochemical analyser. After surgery, the visual acuity of patient was restored to 5/32.

Slit-lamp images of the removed IOL showed refractile fine granular opacities of the anterior IOL surface (Figure 1). The morphology of the IOL and deposits was detected by scanning electron microscope (SEM). Sporadic granular shape deposits, which seemed like calcium salt, were found at IOL surface. In cross-section, the granules were arranged linearly and parallel to the anterior face of IOL (Figure 1). X-ray photoelectron spectrometer (XPS) confirmed that the removed IOL contained significantly more silicon than control IOL. Moreover, small amount of calcium was detected in the removed IOL, while it was completely absent in the control lens (Figure 2).

Aqueous humor was analysed by HITACHI 7170S automatic biochemical analyser. The results showed total protein 0.8 g/L, albumin 0.2 g/L, globulin 0.6 g/L, glucose 4.70 mmol/L, potassium 3.4 mmol/L, sodium 145 mmol/L, chloride 122 mmol/L, calcium 1.34 mmol/L, and phosphorus 0.61 mmol/L.
DISCUSSION
IOL opacification is a rare complication. Studies showed that the most common opacification is seen in hydrogel, hydrophilic acrylic and silicone gel, which are deposits of various kinds. Deposits of hydrophilic acrylic IOL are mainly distributed on the anterior and posterior surface of optical zone, but rarely appear in the peripheral part and haptics. Subsurface and interior deposits had also been reported. In this case, the opacification concentrated on the surface and interior near the surface. However, the area packaged by posterior capsule was transparent. The lamellar morphology of IOL surface opacification was observed by SEM, and confocal microscopy revealed white granular diffuse distribution in the interior. It is now recognised that most deposits of hydrophilic acrylic IOL consist of calcium-phosphate compound. In another case of an Akreos Adapt IOL opacification, calcium and phosphorus was confirmed by X-ray microanalysis. However, XPS showed the peak value of calcium and silicon but not phosphorus in our case. It has been confirmed that silicon could induce calcium-phosphorus deposits on IOL in many studies. Michael et al. also has reported the presence of silicon in the Hydroview hydrogel IOL deposit, and detected the silicon derived from the silicone gasket during the packaging process. But, Bausch and Lomb has changed the packaging system from 2001; and since then, no similar complication has been reported.

Some researchers believe that the change of intraocular micro-environment, especially the aqueous humor calcium phosphate components is the important factor for accelerated calcification. In this study, the patient's aqueous protein concentration was 0.8 g/L, higher than normal. The other aqueous humor biochemical analysis results were in the normal range. Breakdown of the blood-aqueous barrier (BAB) is also a factor in IOL opacification. Many reports about the use of intracameral air during DSAEK (Descemet's stripping automated endothelial keratoplasty) surgery developing IOL opacification suggest that repeated exposure of the hydrophilic IOL to air is responsible.

The counts of corneal endothelial cells was 527.8/mm², and such a low value indicated corneal endothelial decompensation which contribute to breakdown of BAB. Repeated operation of the affected eye increased the chance of IOL exposure to air.

We reported a hydrophilic acrylic intraocular lens (Akreos Adapt AO) opacification and analysed the causes through a series of clinical and laboratory tests. The exact mechanisms are still unclear, but the increased level of calcium and silicon suggests that deposit was composed of calcium salt. Repeated operation is likely to be an etiological factor, as well as decreased endothelial cells. To our knowledge, this is the first report of opacification of the Akreos Adapt AO IOL with detailed pathologic analysis.

REFERENCES


