CASE REPORT

Anterior surface opacification of intraocular lenses after Descemet's stripping automated endothelial keratoplasty

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SUMMARY

Descemet's stripping automated endothelial keratoplasty (DSAEK) is today recognised as the surgical procedure of choice for corneal endothelial dysfunction.¹ The triple procedure (either staged or combined), whereby cataract surgery can be performed at the same time as endothelial keratoplasty, is well suited for patients with Fuch's endothelial dystrophy with decreased vision due to endothelial guttata, early stromal oedema and cataract formation.² Recognised complications of DSAEK include donor graft detachment/dislocation, primary graft failure and pupillary block by air.²⁻⁴ Intraocular lens (IOL) opacification is a complication that is becoming apparent in patients who have undergone DSAEK and, to date, no definitive mechanism of such opacification has been discovered. Primary postoperative optic opacification of hydrophilic acrylic IOL designs has been attributed to the formation of calcium phosphate deposits.^{5,6} This has led to changes in lens designs, manufacturing processes and packaging.⁷ Secondary calcification is thought to be caused by environmental factors unrelated to the IOL model, such as breakdown of the blood–aqueous barrier.⁸ In this report, four cases of IOL anterior surface opacification are described in patients who required both cataract surgery and DSAEK. Only one case had cataract surgery and DSAEK performed concurrently, with the remainder having DSAEK performed at variable timeframes after cataract surgery.

BACKGROUND

ÁNM began writing this paper in October 2013, when these four cases of anterior intraocular lens (IOL) opacification were noticed by two consultants working in the Mater Misericordiae University Hospital in Dublin. This was a completely new phenomenon at the time and it was thought that the opacification was due to calcification, but no definite mechanism for this occurrence has been established to date. All four patients found this opacification debilitating due to the fact that it interfered with their visual acuity. Two of the cases underwent lens explantation as a result of their distress.

The author believes that this opacification is something that corneal surgeons need to be aware of before embarking on a triple procedure. They must identify patients in advance who may potentially be at risk of developing this complication.

CASE PRESENTATION**Case 1**

A 68-year-old woman with a history of Fuch's endothelial dystrophy had a left phacoemulsification and hydrophilic acrylic IOL insertion in October 2010. Postoperatively, it was noted that the iris was entrapped in the wound suture, which required freeing 1 week later. Three months later, she developed corneal decompensation and a left Descemet's stripping automated endothelial keratoplasty (DSAEK) was performed. A TAN EndoGlide system was used for insertion of the graft and postoperative drops used were Pred Forte (prednisolone acetate 1%) and chloramphenicol four times daily. A redo DSAEK was carried out 4 months later, due to graft failure, using an EndoSaver delivery instrument. A left penetrating keratoplasty (PK) was performed in August 2011, due to persistent corneal oedema. Opacification of the central anterior surface of the IOL was first noticed in November 2011, with the patient having a visual acuity of 6/36. An attempt at breaking the opacification with Nd:YAG laser failed, as did an attempted polish of the IOL with Visthesia and a microvitrectomy blade. One month later, the patient had a repeat left PK due to graft failure, with IOL extraction (figure 1).

Case 2

A 69-year-old man with an ocular history of Fuch's endothelial dystrophy and left amblyopia had a triple procedure of left phacoemulsification, IOL insertion and DSAEK, in April 2012. A hydrophilic acrylic lens with a hydrophobic surface (CT Asphina) was implanted and a TAN EndoGlide system was used. Tobradex drops were used intraoperatively. Day one postoperative intraocular pressure measured 44 mm Hg and iris bombé was noted due to pupil block. This was treated with pressure-lowering medication and mydriatics. The patient received Maxitrol (dexamethasone 0.1%, neomycin sulfate 0.35% and polymyxin B sulfate 600 IU/mL) drops four times daily postoperatively. He developed late graft dislocation at day 9, for which he underwent a further procedure involving graft centration and air injection. At a postoperative clinic appointment 1 week later, Urrets Zavalía syndrome was noted. Nd:YAG laser was performed 14 months later due to the presence of posterior capsular opacification, with a subsequent visual acuity of 6/12. In October 2013, visual acuity had

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Figure 1 Explanted lens in case 1.

dropped to 6/18 and central anterior IOL opacification was noted. His graft remains clear.

Case 3

A 75-year-old woman with Fuch's endothelial dystrophy underwent uncomplicated left phacoemulsification and hydrophilic acrylic IOL (Akreos Adapt Advanced Optics (AO)) insertion in November 2009. She developed corneal decompensation in February 2011 and underwent a DSAEK using a TAN EndoGlide system. Postoperative drops consisted of Maxidex (0.1% dexamethasone) and chloramphenicol four times daily. Repositioning of the graft was required 9 days later with intracameral injections of air. She remained on the same course of drops. Primary graft failure led to a redo DSAEK 5 months later. This was complicated by iris prolapse through the wound, requiring a small peripheral iridectomy. Postoperative drops were the same as before. In October 2013, best corrected left visual acuity was 6/9. The patient reported a line blocking her vision in certain fields of view ([figures 2 and 3](#)). Dots were clearly visible on the central anterior surface of the IOL. Eight months later, she opted to undergo a lens exchange.

Case 4

An 83-year-old woman with a history of Fuch's endothelial dystrophy underwent a routine phacoemulsification with hydrophilic acrylic IOL (Akreos Adapt AO) implantation in her right eye. Six months later, a DSAEK was performed in the same eye, using a TAN EndoGlide system with intracameral injections of air to push the graft up against the recipient cornea. Postoperative treatment consisted of Pred Forte (prednisolone acetate 1%) and chloramphenicol drops four times daily. Repositioning of the graft with further intracameral injections of air was required 11 days later due to late graft displacement. Graft failure ensued and the patient's vision dropped to hand movements necessitating a redo DSAEK 4 months after the initial surgery. On this occasion, the tissue was delivered using a pull through technique over a sheets glide. The graft was centred and attached with air. Postoperative treatment was with Maxidex (dexamethasone 0.1%) and chloramphenicol drops four times daily. Non-primary attachment resulted in the need for further air injections and graft centration. Subsequent

Figure 2 Opacification of adapt advanced optics lens in case 3.

corneal decompensation resulted in a right PK, which was performed 6 months later. In March 2012, exactly 1 year after the first DSEK surgery, opacification of the central anterior surface of the right IOL was first documented. Nd:YAG was carried out 3 months later, but right visual acuity remains at 6/60 unaided, which improves to 6/24 with refraction.

OUTCOME AND FOLLOW-UP

This complication is very distressing for patients, and 50% of our patients opted for a lens exchange.

Figure 3 Opacification of adapt advanced optics lens in case 3.

DISCUSSION

There has been a recent emergence, in the peer-reviewed literature, of central anterior IOL opacification post-DSAEK, the incidence of which has been reported at 9.7%.⁹ An exact cause for this complication has not yet been isolated.

Werner *et al*¹⁰ first addressed this phenomenon in April 2012 on noticing an opacification of the anterior surface of the IOL within the pupillary axis in a patient with Fuch's endothelial dystrophy who had undergone phacoemulsification with hydrophilic IOL implantation and subsequent DSAEK with intracameral injections of air. They advised that surgeons should use hydrophobic lenses in patients where cataract surgery is needed concurrently or prior to DSAEK.¹¹ To date, calcification of hydrophobic acrylic lenses post-DSAEK has previously only been described once in the literature.⁹ In our study, a hydrophilic lens with a hydrophobic coating was used in one of the cases.

Patryn *et al*¹ described three cases of a membranous opacification of hydrophilic IOLs after uneventful DSAEK and unremarkable postoperative periods. They proposed that corneal transplantation may cause breakdown of the blood–aqueous barrier (BAB) with a subsequent increase in aqueous protein, cells and calcium content. They also alluded to the fact that BAB breakdown can occur in diabetes due to increased blood vessel permeability, and noted that a state of hypercalcaemia secondary to other medical conditions must be taken into consideration. Also, patients with diabetic retinopathy typically have high aqueous humour calcium concentrations.¹³ None of the patients in our study had any such significant general medical history.

The triple procedure may cause a more extensive and long-lasting breakdown of the BAB.¹⁴ Lee *et al*¹³ suggested that combined surgery leads to increased inflammation and calcium concentration in the anterior chamber. In a study quantifying the breakdown of the BAB following PK with simultaneous extracapsular cataract extraction and posterior chamber lens implantation, Nguyen *et al*¹⁵ indicated that this procedure caused a more extensive and long-lasting breakdown of the BAB than PK alone. To the best of our knowledge, there have been no studies conducted to determine the extent of BAB breakdown after combined DSAEK and cataract extraction.

The use of intracameral air or gas has been postulated as a potential causative factor for IOL opacification post-DSAEK. A laboratory analysis carried out on an explanted opacified IOL, as described by Fellman *et al*,¹⁶ revealed the presence of granular deposits on the anterior surface of the IOL under light microscopy. The patient had undergone two DSAEK procedures and intracameral injection of air after the second surgery in order to reposition the graft. These deposits were densely distributed in a round pattern strictly within the margins of the anterior capsulorhexis. The central granules subsequently stained positive for calcium using a 1% alizarin red solution. Scheimpflug photography also revealed high levels of light scattering from the opacified area. Dhital *et al*¹⁷ described a case of a triple procedure in which sulfur hexafluoride (SF₆) 20% was used to attach the graft to the recipient cornea. Two further injections with air and SF₆ were required to reposition the graft and the patient underwent a subsequent repeat DSAEK with a complete gas fill of 20% SF₆. A central, circular area of opacification of the IOL was noted 1 month later. They also documented two other unrelated procedures (retinal detachment and gas injection for postoperative hypotony) that involved the use of SF₆ and perfluoropropane (C3F8) gases, which subsequently led to a central superficial opacification of the IOLs confined to the

pupillary area. In all four of our cases, air injection into the anterior chamber was used numerous times, be it for graft reattachment or repeat DSAEK. Perhaps repeated direct contact between the IOL surface and the exogenous air has a role to play. Another hypothesis is that calcium-rich aqueous could be driven into the hydrophilic lens by air tamponade, stimulating calcification.¹⁷ However, several rebubbling procedures in other DSAEK cases have been performed that were not complicated by IOL calcification.⁸

Sodium hyaluronate was the viscoelastic device of choice for all of the surgeries conducted in all four patients. Melles¹⁸ has stated that the use of this ophthalmic viscosurgical device at the time of endothelial keratoplasty may interfere with donor attachment and when it is avoided, detachment in the immediate postoperative course is rare. This may lead to reluctance in performing combined cataract surgery.² Three of our cases had donor tissue dislocation, but only one had concurrent cataract surgery, and in one case, sodium hyaluronate (along with air) was used to unfold the graft in a redo DSAEK. Links between viscoelastic use and IOL opacification have been previously described as happening very rapidly after surgery,¹⁹ whereas in the cases described above, opacification occurred several months later.

In conclusion, we have reported on four cases of anterior surface IOL opacification after DSAEK. All cases had a complicated postoperative course. Laboratory analysis of the only explanted IOL was not carried out. Numerous aetiologies have been postulated including the use of intracameral injections of air/gas/viscoelastic leading to metabolic changes in the anterior chamber, a breakdown in the BAB and a prolonged inflammatory reaction after multiple or combined procedures.

Learning points

- ▶ Anterior intraocular opacification post-Descemet's stripping automated endothelial keratoplasty is now becoming a relatively common complication.
- ▶ Patients who may potentially be at risk of developing such a complication should be identified before the surgery and watched carefully postoperatively.
- ▶ The exact mechanism(s) for this opacification/calcification has/have yet to be established.
- ▶ It is a very debilitating complication.

Competing interests None declared.

Patient consent Obtained.

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