Anterior chamber iris-fixated intraocular lens placement in vitreoretinal surgery

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PURPOSE: To report the clinical presentation of retinal detachment (RD) in patients with iris-fixated anterior chamber (AC) intraocular lenses (IOLs), describe their management, and review the outcome of RD repair in these patients.

SETTING: Mater Misericordiae University Hospital, Dublin, Ireland.

METHODS: The medical records of patients undergoing iris-fixated ACIOL implantation and subsequent RD repair over the three-year period from 2008 to 2011 were reviewed. The best corrected visual acuity (BCVA), manifest refraction spherical equivalent and axial length of these patients prior to their refractive surgery was noted. The time between IOL placement and presentation with RD was recorded. The fundal findings at presentation with RD were documented. The outcome of vitreoretinal (VR) surgery for RD repair and BCVA following this was recorded.

RESULTS: RD occurred in 5 eyes of 4 patients with a mean time between IOL implantation and detachment of 11.3 months. U-tears and atrophic holes were found in 1 and 4 eyes, respectively. Three eyes underwent scleral buckling surgery, 2 underwent pars plana vitrectomy surgery. Anatomical retinal reattachment was achieved after a single surgery in all eyes. Mean BCVA after RD repair was 0.15 logMAR.

CONCLUSION: Conventional VR surgical intervention after ACIOL implantation is possible and can achieve an excellent visual outcome in patients with these lenses that develop RD. The presence of an iris-fixated ACIOL does not hinder such surgery.

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The incidence of retinal detachment (RD) is higher in myopic eyes than in emmetropic eyes1. RD in the former is thought to be influenced by four factors associated with myopia: longer axial length, premature vitreous liquefaction, posterior vitreous detachment and increased prevalence of peripheral retinal degenerations including lattice degeneration. Pseudophakia also increases the risk of RD2. The incidence of RD after phacoemulsification cataract surgery is estimated to range from 0% to 3.6%3,4. Up to 40% of patients referred to vitreoretinal (VR) surgeons for retinal reattachment surgery have had prior cataract extraction5. It is estimated that the risk of pseudophakic RD in myopic eyes with an axial length > 25 mm is 6 times higher than in those with shorter axial length6,7. Concern exists that intraocular lens (IOL) implantation, rather than simply the myopia it often corrects, could be a cause, or at least a contributing factor, of RD after iris-fixated anterior chamber (AC) IOL implantation. The presence of an iris-fixated ACIOL may present a new challenge to the VR surgeon confronted with RD repair in a patient in whom such a lens has been placed. Little information is currently available on RD repair in patients with iris-fixated ACIOLs5.
We report the clinical presentation of RD in patients with iris-fixed ACIOLs, describe their management, and review the outcome of RD repair in these patients.

PATIENTS AND METHODS

Before refractive surgery each patient underwent a complete ocular examination which included an assessment of best corrected visual acuity (BCVA) and manifest refraction spherical equivalent (MRSE), measurement of intraocular pressure (IOP) using a Goldmann applanation tonometer and axial length using the IOL Master® (Carl Zeiss Meditec AG, Jena, Germany), and slit-lamp microscopy including dilated fundoscopy.

Anterior chamber intraocular lens implantation

All ACIOLs were implanted in eyes with stable myopia of between −3.00 and −12.00 dioptres (D), an endothelial cell count (Cellchek, Konan Medical, Irvine, California, USA) greater than 2,500 cells/mm² and a normal anterior segment with an AC depth of greater than 3 mm measured using the IOL Master®. ACIOl implantation was performed by two surgeons. In all eyes, the IOL was introduced via a 6 mm superior corneal incision and the iris enclavated in each of the haptics of the IOL using an enclavation needle via a nasal and temporal corneal paracentesis.

Retinal detachment surgery

Patients had presented with a subjective reduction in visual acuity, floaters, or the observation of a shadow in their visual field when RD was noted. The number, location and morphological features of the causative retinal break or breaks were recorded in addition to the extension of the RD and the presence or absence of proliferative vitreoretinopathy.

RD repair was performed by a single surgeon. Surgical technique, gas tamponade used, if any, BCVA, and duration of follow-up after VR surgery were noted. Scleral buckling (SB) surgery was performed under general anaesthesia. Cryotherapy was used to treat retinal breaks and a silicone sponge placed (5 mm sponge [Type 506] or a grooved 3.5 × 7.5 mm sponge [Type 509G]; FCI Ophthalmics, Massachusetts, USA). Pars plana vitrectomy (PPV) surgery was performed under sub-Tenon's local anaesthesia using standard 3 × port 23-gauge sclerostomies. Eyes underwent full vitrectomy. Scleral compression was used to assist removal of the peripheral vitreous. Cryotherapy or endophotoacoagulation was used to treat retinal breaks. Patients were instructed to assume an appropriate head position postoperatively.

All patients gave their informed consent for the inclusion of their details in this study.

RESULTS

Five eyes of 4 patients with iris-fixed ACIOL implantation developed RD. Iris-fixed ACIOL implantation was performed in around 420 consecutive eyes over the course of the study period. The overall incidence of RD in this cohort is thus estimated to be 1.2%. Mean patient age at the time of RD was 48.4 ± 13.0 years (range 33.1 to 64.3). One female and three male patients developed RD. Three right eyes and 4 left eyes were affected.

One patient had received Artiflex® IOLs (Ophtec, Groningen, The Netherlands) as phakic IOLs (PIOLs) to correct myopia. Another patient had received Artiflex® Toric IOLs, also as PIOLs to correct myopic astigmatism. One patient had received Artisan® IOLs (Ophtec) to correct aphakia following sequential bilateral vitrectomy and lensectomy for familial ectopia lentis. One patient with Marfan Syndrome had received Artisan® IOLs at the time of sequential vitrectomy and lensectomy for bilateral lens subluxation, and developed left and subsequently right RD. Table 1 describes the clinical characteristics of our patients.

Mean MRSE before IOL implantation was −10.13 ± 1.04 D (range −7.00 to −12.00 D). Mean axial length of these patients that developed RD was 26.6 ± 2.6 mm (range 23.9 to 31.0). Mean time between IOL implantation and RD detection was 11.3 ± 10.6 months (range 0.5 to 29 months). In one case, RD was subsequent to blunt trauma.

Table 2 summarizes the individual clinical course of each of our patients. RD was associated with a U-tear in one case and atrophic holes in 4 cases. Four eyes had a single causative retinal break. One eye had multiple retinal breaks.

An SB procedure was performed in three eyes: in one, 100% SF₆ gas was used as tamponade; air was used as tamponade in another; and no tamponade was used in the third. PPV was performed in two eyes, with 20% SF₆ and 16% C₃F₇ used as tamponade in these cases. Retinal reattachment was achieved in all eyes after a single reparative surgical procedure. No patients required explantation of ACIOL for RD repair. All iris-fixed ACIOLs remained well enclavated after VR surgery.

Before RD, mean BCVA in these patients was 0.09 ± 0.09 logMAR. At presentation with RD mean BCVA was 0.29 ± 0.09 logMAR, and at last follow-up mean BCVA was 0.15 ± 0.08 logMAR. The duration of follow-up after RD was, on average, 10.8 ± 5.8 months (range 3-17 months). At last follow up, the retina had remained attached in all cases.

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### Table 1. Characteristics of patients with iris-fixated anterior chamber intraocular lenses and retinal detachment.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Age (years)</th>
<th>Affected eye</th>
<th>Diagnosis</th>
<th>Axial length (mm)</th>
<th>IOL type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>31</td>
<td>Right</td>
<td>High myopia</td>
<td>31.04</td>
<td>Artiflex® PIOL</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>59</td>
<td>Left</td>
<td>Myopic astigmatism</td>
<td>25.95</td>
<td>Artisan® Toric PIOL</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>43</td>
<td>Right/Left</td>
<td>Marfan syndrome</td>
<td>26.24 / 26.12</td>
<td>Artisan®/Artisan’</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>65</td>
<td>Right</td>
<td>Ectopia lentis</td>
<td>23.87</td>
<td>Artisan’</td>
</tr>
</tbody>
</table>

IOL = Intraocular lens; PIOL = Phakic intraocular lens.

### Table 2. Clinical course of patients with retinal detachment after iris-fixated anterior chamber intraocular lens implantation.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Time from IOL implantation to RD (months)</th>
<th>History of trauma</th>
<th>Retinal breaks/s</th>
<th>BCVA with IOL</th>
<th>BCVA with RD</th>
<th>BCVA after RD repair</th>
<th>RD surgery</th>
<th>Duration of follow up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29</td>
<td>Yes</td>
<td>Multiple superior and inferior breaks</td>
<td>6 / 7.5</td>
<td>6 / 15</td>
<td>6 / 9 post LASEK</td>
<td>C / B / 20% SF₆</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>No</td>
<td>ST U-tear</td>
<td>6 / 9</td>
<td>6 / 12</td>
<td>6 / 9</td>
<td>C / B / Air</td>
<td>12</td>
</tr>
<tr>
<td>3 OD</td>
<td>9</td>
<td>No</td>
<td>Inferior hole</td>
<td>6 / 5</td>
<td>6 / 6</td>
<td>6 / 9.5</td>
<td>C / B</td>
<td>12</td>
</tr>
<tr>
<td>3 OS</td>
<td>0.5</td>
<td>No</td>
<td>Superior hole</td>
<td>6 / 5</td>
<td>6 / 12</td>
<td>6 / 7.5</td>
<td>PPV / C / 18% C₂F₅</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>No</td>
<td>Superior hole</td>
<td>6 / 9</td>
<td>6 / 9</td>
<td>6 / 6</td>
<td>PPV / C / 20% SF₆</td>
<td>10</td>
</tr>
</tbody>
</table>

RD = Retinal detachment; IOL = Intraocular lens; BCVA = Best corrected visual acuity; C = Cryotherapy; B = Buckle; OD = right eye; OS = left eye; PPV = Pars plana vitrectomy; ST = Superotemporal; LASEK = Laser assisted subepithelial keratoplasty.

### Discussion

Several surgical treatments for myopia are available, including corneal refractive procedures, laser assisted stromal in situ keratomileusis (LASIK), laser assisted subepithelial keratoplasty (LASEK), clear lens extraction with IOL implantation, and PIOL implantation. The last of these is currently one of the more preferred methods of correcting high myopic refractions.

Ectopia lentis can occur as an ocular manifestation of systemic disorders such as Marfan’s disease, homocystinuria and Weil Marchesani syndrome. Idiopathic ectopia lentis has also been described. In any of these cases, lens subluxation causes myopic astigmatism. PPV and lensectomy which renders the affected eye aphakic is the surgical treatment of choice in the majority of these patients. The implantation of iris-fixated ACIOLs has become a popular management strategy for patients with ectopia lentis following this type of surgery.

The popular Artisan® and Artiflex® IOLs are anchored only to the mid periphery of the iris. Elsewhere they are slightly raised above the iris plane, preventing them from interfering with the usual constriction and dilation of the iris and the structures of the AC angle.

Cases of unilateral and even bilateral giant retinal tear (GRT) associated RD after Artisan® PIOL implantation have been reported. In the second of these cases, bilateral GRT associated RD occurred soon (2 months) after Artisan® IOL implantation in highly myopic (OD –6.00 D and OS –7.50 D) eyes with an axial length of OD 25.00 mm and OS 25.83 mm in an individual without Stickler or Marfan Syndrome who had had an unremarkable preoperative fundus examination. Perioperative fluctuations in IOP and/or surgically induced inflammatory response were thought to have produced changes in the vitreous which promoted retinal traction and predisposed the affected patient to RD, suggesting an aetiological association between Artisan® IOL implantation and the development of RD.
ACIOL implantation may be a contributing factor in the development of RD. RD develops in 0.7%-2.3% of myopic eyes\(^1\), and has been found to develop in 2.9%-7.1% of eyes with an iris-fixated PIOL, occurring on average 24.4 ± 24.4 months (range 1-92) after IOL implantation\(^2\).

However, the incidence of RD after cataract surgery complicated by posterior capsular tear and vitreous loss (a patient group that, like those with a myopic refractive error, are at increased risk of RD\(^3\)) has been found to be similar for patients receiving either an anterior or a posterior chamber IOL. This suggests that neither the placement nor the presence of an ACIOL greatly increases the risk of RD, if at all\(^4\).

In the cases described here, given the temporal relationship between ACIOL placement and the development of RD, it is reasonable to assume that high myopia and/or the presence of other already well defined risk factors for RD such as Marfan Syndrome or blunt trauma were the major contributing factors to RD development. Pre-ACIOL implantation counselling should, therefore, include a discussion of the possible risk of RD in patients planning such surgery to correct myopia\(^5\). Longer axial length (> 30.24 mm) has been identified as a particular risk factor for RD development in myopic eyes following this type of refractive surgery\(^6\). Little information on RD repair in patients with iris-fixated ACIOLs is currently available\(^7\). RD repair has a worse prognosis when only an incomplete view of the ora serrata can be obtained\(^8\). This problem was frequently encountered with the older iris claw lenses which significantly limited pupil dilatation\(^9\), but does not appear to occur with Artisan\(^\circ\) or Artiflex\(^\circ\) IOLs which, as already mentioned, do not affect normal iris function. Indentation can improve visualization of the peripheral retina\(^10\), and this is often further improved by the absence of a lenticular capsular bag and its associated peripheral aberrations\(^11\). Given the current tendency for cataract surgeons to opt for smaller anterior capsulorrhexis openings and smaller diameter lenses, visualization in the presence of an Artisan IOL may be the same if not better than that obtained with a standard posterior capsule IOL\(^12\). In the cases described here, intra-operative manipulations during SB or PPV were performed without difficulty. SB and PPV surgery were effective in the treatment of RD in these patients. SB has the disadvantage of causing postoperative refractive error\(^13\), while such refractive changes can be avoided with PPV, although the major disadvantage of this technique is frequently subsequent development of nuclear sclerosis. Anterior movement of the crystalline lens after vitrectomy might result in close contact with the PIOL, which may contribute to cataract formation.

Precautions are necessary when performing VR surgery in patients with Artisan\(^\circ\) lenses. Gas in the vitreous cavity can push the lens against the endothelium. Injecting viscodispersive into the superior portion of the AC will prevent contact between the endothelium and IOL. IOP usually remains in a reasonable range if acetazolamide is given postoperatively. With short term gas tamponade, for instance, a bubble that is expected to disappear completely in 7 to 10 days, reinjection of Healon\(^\circ\) (Abbott Medical Optics) is not often required\(^14\).

The prognosis for RD repair in patients with ACIOLs appears to be excellent. Our small series demonstrates that good reattachment rates can be achieved in patients with iris-fixated ACIOLs, i.e. successful retinal reattachment was achieved after a single procedure in all of our cases. The reattachment rate of detached retina in eyes with iris-fixated IOLs after one operation has previously been shown to be less than the post-conventional posterior chamber IOL implantation detachment rate\(^15\). Overall however, the rate of reattachment between these two groups was comparable.

In this paper we present our experience in repairing RD in a small cohort of patients in whom iris-fixated ACIOLs were implanted. Nonetheless, our study correlates with the opinion of others, namely, that the presence of the current generation of ACIOLs does not hinder VR surgery to any great extent, and excellent visual outcomes can be achieved.

REFERENCES


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