Myopic iris-claw intraocular lens for late intraocular lens–capsular bag complex dislocation using the T2 formula

Valentin Huerva, MD, PhD

A 75-year-old white woman with a history of high myopia and bilateral cataract surgery presented with dislocation of the intraocular lens (IOL)–capsular bag complex in her left eye. Exchange of the complex and an iris-claw IOL aphakia model were proposed. Because the lowest power for this IOL was +2.0 diopters (D), an Artisan IOL (−3.0 D) with an estimated A-constant of 103.8 for negative powered IOLs using the SRK/T2 formula was implanted. Three months after selective sutures were removed, the refraction was +0.75 − 1.25 × 100 (spherical equivalent [SE] +0.125 D) and the corrected distance visual acuity was 20/100 (Snellen). The iris-claw IOL model for myopia correction may be used in cases of IOL–capsular bag complex dislocation in patients with high myopia. The outcome may be more predictable with the SRK/T2 formula.

Financial Disclosure(s): The author has no financial or proprietary interest in any material or method mentioned.

JCRS Online Case Reports 2014; 2:e38–e40 © 2014 ASCRS and ESCRS

Dislocation of an intraocular lens (IOL) within the capsular bag may occur many years after uneventful cataract surgery as a result of previous progressive zonular disintegration and capsule shrinkage. The most commonly reported associated condition is pseudoxfolliation. However, a recent study reports that high myopia may be the main risk factor for late in-the-bag IOL dislocation.

When in-the-bag IOL dislocation occurs, intervention measures must be performed immediately because of the imminent risk for IOL–capsular bag complex dislocation into the vitreous cavity. It is usually preferable to intervene surgically while an anterior approach is still possible. Management includes IOL exchange, replacement with an anterior chamber IOL, or suturing the IOL through the bag to the iris or the sclera. The advantage of repositioning and suturing the IOL is that it avoids a large incision. However, this is not possible in some cases due to the IOL dislocation into the vitreous cavity or the appearance of the vitreous in the anterior chamber; instead, exchange of the IOL–capsular bag complex and anterior vitrectomy may be preferable. Aphakia correction can be performed using a new sulcus-sutured or glued IOL, an anterior angle-supported IOL, or an iris-claw IOL. Iris-claw IOLs with a diopter (D) power range of +2.0 to +30.0 D are available for aphakia correction. In some highly myopic patients, emmetropia cannot be achieved within this range. Other models designed to correct myopia should be used instead. However, calculating the power of these IOLs in these patients is challenging. We present the treatment of late in-the-bag IOL dislocation in a highly myopic patient involving exchange of the dislocated IOL–capsular bag complex and implantation of an iris-claw IOL using the SRK/T2 formula.

CASE REPORT

A 75-year-old white woman with a history of high myopia and bilateral cataract surgery in 1996 presented with visual disturbances of 1-month duration in the left eye in July 2013. She did not report the amount of previous myopia. Of her history, it was only known that she had phacoemulsification with IOL implantation. The IOLs were nonfoldable 1-piece poly(methyl methacrylate) (PMMA) IOLs (Storz...
Ophthalmics), with powers of +1.0 D in the right eye and +3.0 D in the left eye. In 2007, the refractive outcome was –2.0 –2.0 × 50 in the right eye and –1.0 –2.0 × 80 in the left eye. The corrected distance visual acuity (CDVA) with this refraction was 20/100 in both eyes. On examination, the CDVA remained 20/100 in the right eye but varied from counting fingers to 20/100, according to head and IOL movements, in the left eye. In the right eye, the pseudophakia remained correct and intact; however, in the left eye, an inferior dislocation of the IOL–capsular bag complex was identified.

The ocular pressure was 12 mm Hg in both eyes. Fundus examination showed degenerative myopia without peripheral rheumatogenous lesions. After the patient was informed about the IOL dislocation, 2 treatment possibilities were presented: IOL suture fixation or exchange of the subluxated IOL and implantation of an anterior chamber IOL (iris-claw or angle-supported). The patient opted for the iris-claw IOL. She did not want a second intervention, which was a possibility with a sutured IOL. An Artisan aphakia IOL (Ophtec) was proposed. Optical biometry with partial coherence interferometry (IOLMaster, Carl Zeiss Meditec) showed the following for the left eye: axial length, 31.77 mm; K1, 44.70 @ 89; K2, 46.62 @ 179; anterior chamber depth, 3.88 mm; and total astigmatism, –1.92 @ 89. The IOL power results using the SRK/T formula and a 115.7 A-constant were –5.5 D (Haigis, 4.0 D; Holladay 1, –4.5 D; Hoffer Q, –5.5 D). The minus power available for this IOL is –2.0 D. The IOL manufacturer was consulted and recommended use of the SRK/T2 formula with an Artisan myopia IOL having an estimated A-constant of 103.8 for negative-powered IOLs; the emmetropia calculation for this IOL was –2.82 D.

The surgical procedure performed consisted of a superior limbal incision, exchange of the dislocated IOL–capsular bag complex, anterior vitrectomy of the vitreous strands, iridectomy, implantation of a –3.0 D iris-claw IOL, and 4 radial nylon 10-0 sutures. The surgery was uneventful. Three months later, after removal of selective sutures, the refraction was +0.75 –1.25 × 100 (SE +0.125 D), with a CDVA of 20/100. The patient was pleased with the outcome of the surgery as the visual discomfort disappeared and the preoperative CDVA was retained.

**DISCUSSION**

Management of IOL–capsular bag complex dislocation includes IOL exchange and replacement with an anterior chamber IOL (iris claw or angle supported) or suturing the IOL through the bag to the iris or the sclera.3–5 Angle-supported IOLs may produce secondary glaucoma, endothelial cell loss, pupil distortion, and IOL instability; for these reasons, they are not widely accepted. The advantage of suturing the IOL is that it avoids a large incision.7 Iris-claw and sutured IOLs produce comparable improvements in visual acuity; however, new dislocations may occur more frequently in sutured cases.9,10 Follow-up studies have shown that iris-claw IOLs used for aphakia correction are effective, predictable, and safe long-term.11 However, these studies used the same A-constant (115.0) and SRK/T formula for all patients.10,11 This may be a source of refractive error in high-myopia cases and should be taken into account. For primary IOL implantation during cataract surgery or refractive lens exchange, optimized constants for SRK/T, Haigis,12 Hoffer Q,13 and Holladay 114 formulas are necessary in highly myopic eyes15,16 to minimize the deviation between postoperative refraction and the target refraction. Without optimized constants, postoperative hyperopic refractive error occurs with all formulas.15,16

Good predictability of the refractive outcome with Artisan IOLs makes this IOL a suitable option for highly myopic patients.17 The van der Heijde formula18 is used in phakic conditions for IOL calculation in myopic patients. For high-myopic aphakic patients, the aphakic iris-claw power range is not sufficient. An alternative is to use the Artisan iris-claw model for myopia with an available power range of –1.0 to –23.5 D. Foldable models are also disposable. In our case, we chose the rigid PMMA model 6.0 mm optic because the subluxated IOL had to be explanted. Using the A constant for the negative-powered IOLs, according to the modified SRK/T formula (ie, SRK/T2),7 we obtained an SE approaching emmetropia. In addition to published results for iris-claw IOLs, the iris-claw myopic IOL is a good alternative to avoid the expected hyperopic refractive result when an IOL must be explanted due to IOL dislocation. According to these results, the foldable models could be used in cases of myopic aphakia.

A 10% reduction in the endothelial cell count can occur years after surgery with an iris-claw IOL, and some physicians have expressed concern about long-term corneal damage. However, studies have demonstrated that iris-claw IOLs do not result in a significant loss of endothelial cell density after implantation.19,20 There is no specific report of corneal decompensation among the patients, and the endothelial cell loss might be what one would expect after surgical IOL exchange and not necessarily from using the iris-claw IOL.21 Nonetheless, one should monitor the status of the endothelium in patients with iris-claw IOLs. This is not a drawback given that patients with angle-supported IOLs have to be monitored in the same way.

In conclusion, the iris-claw IOL models for myopia correction may be used in cases of IOL–capsular bag complex dislocation in highly myopic patients. The procedure may be more predictable when the SRK/T2 formula is used.

**REFERENCES**

1. Auffarth GU, Tsao K, Wesendahl TA, Sugita A, Apple DJ. Centration and fixation of posterior chamber intraocular lenses in eyes with pseudoxfoliation syndrome; an analysis of explanted autopsy eyes. Acta Ophthalmol Scand 1996; 74:463–467
2. Jehan FS, Mamalis N, Crandall AS. Spontaneous late dislocation of intraocular lens within the capsular bag in pseudoexfoliation patients. Ophthalmology 2001; 108:1727–1731
3. Gross JG, Kokame GT, Weinberg DV, for the Dislocated In-The-Bag Intraocular Lens Study Group. In-the-bag intraocular lens dislocation. Am J Ophthalmol 2004; 137:650–635
4. Gimbel HV, Condon GP, Kohnen T, Olson RJ, Halkiadakis I. Late in-the-bag intraocular lens dislocation: prevention, protection, and management. J Cataract Refract Surg 2005; 31:2193–2204
5. Fernández-Buenaga R, Alio JL, Pérez-Ardoy AL, Larrosa-Quesada A, Pinilla-Cortés L, Barraquer R, Alio JL, Muñoz-Negrete FJ. Late in-the-bag intraocular lens dislocation requiring explantation: risk factors and outcomes. Eye 2013; 27:795–801
6. Drolsum L, Ringvold A, Nicolaisen B. Cataract and glaucoma surgery in pseudoexfoliation syndrome: a review. Acta Ophthalmol Scand 2007; 85:810–821. Available at: http://www3.interscience.wiley.com/cgi-bin/fulltext/118515723/PDFSTART. Accessed February 28, 2014
7. Sheard RM, Smith GT, Cooke DL. Improving the prediction accuracy of the SRK/T formula: the T2 formula. J Cataract Refract Surg 2010; 36:1829–1834
8. Evereklioglu C, Er H, Bekir NA, Borazan M, Zorlu F. Comparison of secondary implantation of flexible open-loop anterior chamber and scleral-fixated posterior chamber intraocular lenses. J Cataract Refract Surg 2003; 29:301–308
9. Hirashima DE, Soriano ES, Meirelles RL, Alberti GN, Nosé W. Outcomes of iris-claw anterior chamber versus iris-fixated foldable intraocular lens in subluxated lens secondary to Marfan syndrome. J Cataract Refract Surg 2010; 11:1479–1485
10. De Silva SR, Arun K, Anandan M, Glover N, Patel CK, Rosen P. Iris-claw intraocular lenses to correct aphakia in the absence of capsule support. J Cataract Refract Surg 2011; 37:1667–1672
11. Chen Y, Liu Q, Xue C, Huang Z, Chen Y. Three-year follow-up of secondary anterior iris fixation of an aphakic intraocular lens to correct aphakia. J Cataract Refract Surg 2012; 38:1595–1601
12. Haigis W. The Haigis formula. In: Shammas HJ, ed. Intraocular Lens Power Calculations. Thorofare, NJ, Slack, 2004; 41–57
13. Hoffer KJ. The Hoffer Q formula: a comparison of theoretic and regression formulas. J Cataract Refract Surg 1993; 19:700–712; errata, 1994; 20:677; 2007; 33:2–3
14. Holladay JT. Holladay IOL Consultant User’s Guide and Reference Manual. Houston TX, Holladay Lask Institute, 1999
15. Petermeier K, Gekeler F, Messias A, Spitzer MS, Haigis W, Szurman P. Intraocular lens power calculation and optimized constants for highly myopic eyes. J Cataract Refract Surg 2009; 35:1575–1581
16. Terzi E, Wang L, Kohnen T. Accuracy of modern intraocular lens power calculation formulas in refractive lens exchange for high myopia and high hyperopia. J Cataract Refract Surg 2009; 35:1181–1189
17. Tahzib NG, Bootsma SJ, Eggink FA, Nuijts RM. Functional outcome and patient satisfaction after Artisan phakic intraocular lens implantation for the correction of myopia. Am J Ophthalmol 2006; 142:31–39
18. van der Heijde GL. Some optical aspects of implantation of an IOL in a myopic eye. Eur J Implant Refract Surg 1989; 1:245–248
19. Pop M, Payette Y. Initial results of endothelial cell counts after Artisan lens for phakic eyes; an evaluation of the United States Food and Drug Administration Opttec Study. Ophthalmology 2004; 111:309–317. Available at: http://www.leeeye.kr/popup/non/Artisan2.pdf. Accessed February 28, 2014
20. Sminia ML, Odenthal MT, Prick LJ, Mourits MP, Völker-Dieben HJ. Long-term follow-up of the corneal endothelium after aphakic iris-fixed IOL implantation for bilateral cataract in children. J Cataract Refract Surg 2011; 37:866–872
21. Stürmer J. [Linsenaustausch bei subluxierten Kapselsack- und Sulkuslinsen] Lens exchange for subluxation of posterior chamber lenses implanted in the capsular bag or in the ciliary sulcus. Klin Monatsbl Augenheilkd 2013; 230:317–322