Clinical Ophthalmology

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Long-Term Outcome and Complications of IOL-Exchange

David A Märker[1], Viola Radeck[1], Teresa Barth[1], Horst Helbig[1], Nicolas CD Scherer[1,2]

[1]Department of Ophthalmology, Universitätsklinikum Regensburg, University of Regensburg, Regensburg, Bavaria, Germany; [2]Department of Ophthalmology, Ludwig-Maximilians-University, Munich, Bavaria, Germany

Correspondence: David A Märker, Klinik und Poliklinik für Augenheilkunde, Universitätsklinikum Regensburg, Franz-Josef-Strauss Allee 11, Regensburg, 93051, Germany, Tel +49 941 944 9206, Fax +49 941 944 9202, Email David.Maerker@klinik.uni-regensburg.de

Purpose: To describe the long-term outcome after intraocular lens (IOL) exchange for IOL-opacification with a focus on any occurring complications.

Patients and Methods: Patients with an IOL exchange for opacified IOLs (Lentis LS-502-1) were identified. Medical records and information from the treating ophthalmologists were reviewed. Visual outcomes and any occurring complications after the IOL exchange were analyzed.

Results: IOL exchange was performed in 48 eyes of 46 patients and significantly improved best-corrected distance visual acuity from 0.42 ± 0.32 logMar (mean ± SD) in opacified lenses to 0.25 ± 0.28 logMar after IOL exchange. Nine of the 48 eyes (19%) underwent 11 further surgical procedures for complications due to four indications: IOL dislocation (n = 2, 4%), retinal detachment (RD) (n = 6, 12%), epiretinal membrane (n = 2, 4%), and pupillary block (n = 1, 2%). Three eyes (6%) developed a temporarily elevated intraocular pressure. Temporary postoperative cystoid macular edema was found in 2 eyes (4%).

Conclusion: IOL exchange can restore vision owing to IOL opacification in most cases. Nonetheless, IOL exchange is not an easy or risk-free procedure. This may lead to sight-threatening complications, even in eyes without predisposing ocular comorbidities.

Keywords: intraocular lens (IOL) exchange, complications, IOL opacification, treatment of complications

Introduction

Cataract surgery is one of the most common, successful, and safe medical procedures performed. However, in a few cases (0.26–0.77%), the implanted intraocular lens (IOL) exchange is necessary.[1–4] Indications for the exchange of posterior chamber IOLs include IOL dislocation, incorrect choice of refractive power, patient dissatisfaction with multifocal IOL, and IOL opacification.[5,6]

IOL opacification is a phenomenon well documented, especially in hydrophilic acrylic IOLs.[5–7] These lenses comprise a high water content, allowing increased flexibility in small incision cataract surgery.[5] Several studies have demonstrated that hydrophilic acrylic lenses opacify due to calcification on the IOL surface or within the lens material.[6–8] We have reported serial opacification of a hydrophilic-hydrophobic acrylic IOL (Lentis LS-502-1, Oculentis GmbH) requiring the exchange of the opacified IOL.[9] Here, we analyzed the long-term outcome after the IOL exchange, focusing on visual recovery and any occurring complications.

Materials and Methods

This study was performed at the Department of Ophthalmology of the Regensburg University Hospital. This study was approved by the local ethics committee (Votum 18–863-101), and adhered to the tenets of the Declaration of Helsinki.

Patients who underwent Lentis LS-502-1 IOLs implantation between February 2008 and March 2012 were contacted by mail and asked for written informed consent, including a request to obtain information from their treating ophthalmologists. Data from the clinic's medical records and a questionnaire provided by the treating ophthalmologists were analyzed.[9]

Received: 24 August 2023
Accepted: 20 October 2023
Published: 31 October 2023

Two well-experienced surgeons carried out the primary cataract surgeries.

For all explantation cases, we investigated the general and ophthalmic conditions and subsequent intraocular surgical procedures. Preoperative and postoperative examinations included BCDVA, biomicroscopy, tonometry, and dilated fundus examination. BCDVA values were measured after initial cataract surgery, calcification, IOL exchange, and additional surgery. BCDVA was measured using the Snellen scale at 5 m and converted to a decimal scale and logarithm of the minimum angle of resolution (logMAR) values for statistical calculations. Patients who could barely perceive hand movements were assigned a BCDVA of 0.001 on a decimal scale (3.0 logMAR). IOL calcification was diagnosed based on a careful slit-lamp examination.

IOL exchange was performed in patients with significant visual impairment owing to IOL opacification by one surgeon (HH) with experience in >10.000 cataracts and >10.000 vitrectomy cases, including IOL exchange. To explant the opacified IOL, a superior corneoscleral tunnel (3.0 or 7.0 mm) after opening the conjunctiva was prepared, and the anterior chamber was filled with healon. Using an iris spatula, the adhesion between the IOL haptics and anterior and posterior lens capsule was carefully mobilized circularly. In some cases, radial cuts to the anterior capsule were made to facilitate IOL mobilization. After mobilization, the IOL was rotated into the anterior chamber and either removed through the tunnel in one piece or cut intraocularly into two halves. The new IOL was placed in a preserved capsular bag or the ciliary sulcus if possible. If the zonular stability was insufficient, the lens capsule and IOL were removed, and anterior vitrectomy was performed. Subsequently, an iris-claw IOL was placed retroiridally.

Statistical analyses were performed using IBM SPSS Statistics version 25 (IBM Inc., Chicago, IL, USA). Descriptive statistics were used (absolute [n] and percentage [%] frequencies, and mean ± SD).

Results

As shown before, Lentis LS-502-1 was implanted 1204 times in 1025 patients between February 2008 and March 2012. Detailed information regarding the sample has been reported.[9]

IOL exchange was performed at our clinic in 48 eyes of 46 patients (29 men and 17 women). The mean age of the patients was 67.4 ± 9.8 (mean ± SD). IOL opacification occurred in a mean interval of 42.5 months ± 19.0 (range 1 to 84 months). IOL exchange occurred in a mean interval of 44.9 months ± 20.5 (8–92 months) after initial IOL implantation. IOL exchange significantly improved BCDVA from 0.42 ± 0.32 logMar in opacified IOL to 0.25 ± 0.28 logMar after lens exchange.[9]

In 2 eyes (4.2%), an AcrySof IOL (Alcon Inc.) was placed in the intact capsule. A 3-piece IOL (Hoya Inc.) was placed in the ciliary sulcus in 35 eyes (72.9%) because of significant posterior capsule defects after YAG laser capsulotomy. In 11 of 48 eyes (22.9%), firm adhesions were observed between the IOL and capsular bag, combined with an unstable zonule that was managed by removal of the capsule and implantation of a Verisyse (Johnson & Johnson Inc.) iris-claw IOL placed retroiridally. Anterior vitrectomy was performed in 19 (40%) patients. During the IOL-exchange procedure, a complete vitrectomy was not performed in any of the presented cases. No other intraoperative complications were noted.

The mean interval between initial IOL implantation and explantation was 40.1 months ± 26.1 (range, 16–92 months) for eyes in which removal of the capsular bag was necessary and was 44.4 months ± 17.4 (range, 8–84 months) for eyes with IOL implantation in the ciliary sulcus. Both eyes in which the new IOL was implanted in the capsular bag showed an interval of 80 months.

An analysis of postoperative complications occurring after IOL explantation was performed for 48 of 46 patients based on a minimum one-year follow-up, a record of any complication treated at our clinic, or sufficient information by the treating ophthalmologists.

During the postoperative course, 9 of the 48 eyes (18%) underwent 11 further surgical procedures because of four indications: IOL dislocation (n = 2, 4%), retinal detachment (RD) (n = 6, 12%), epiretinal membrane (n = 2, 4%), and pupillary block (n = 1, 2%).

Two patients (4%) developed temporary cystoid macular edema. Table 1 shows the nine explant cases with complications after IOL exchange requiring additional surgery.

Table 1 Explant Cases with Complications Necessitating Surgical Therapy

Case	1	2	3	4	5	6	7	8	9
Sex	Male	Male	Male	Male	Male	Female	Male	Male	Male
Age at IOL exchange	74	72	71	72	82	63	80	79	59
Position of substitute IOL	Capsular bag	Iris claw	Sulcus	Iris claw	Iris claw	Sulcus	Sulcus	Sulcus	Sulcus
Complications / Events	Disloc	RD, Disloc	RD	RD	RD	RD	RD, PupB	MacP	MacP
Months after IOL exchange	0.5	11 and 18	34	3	1	6	2 and 2.5	5	6
Treatment	IOL exchange	ppvg and Repos	ppvg	ppvg	ppvg	ppvg	ppvg and Iridotomy	peeling	peeling
BCDVA after initial implantation (logMAR)	0.00	0.00	0.70	0.10	0.20	0.00	0.00	0.10	0.00
BCDVA after IOL exchange (logMAR)	0.00	0.10	0.70	0.20	0.50	0.10	0.00	0.30	0.00
BCDVA after additional surgery (logMAR)	0.00	0.10	0.80	0.10	0.60	0.10	0.10	0.20	0.18
Ocular comorbidities and previous ocular surgery	Yag-CT	NPDR	MacP, MP, RT	—	RT	RT	Yag-CT	MLH, PCO, Yag-CT	RD, RT

Abbreviations: IOL, intraocular lens; BCDVA, best-corrected distance visual acuity; Disloc, IOL dislocation; RD, retinal detachment; PupB, pupillary block; MacP, macular pucker; ppvg, pars plana vitrectomy including injection of gas; Repos, reposition of the dislocated IOL; MP, membrane peeling; Yag-CT, Yag-capsulotomy; NPDR, non-proliferative diabetic retinopathy; RT, retinal tear(s); MLH, macular lamellar hole; PCO, posterior capsule opacification.

One of the two eyes with the new IOL in the capsular bag showed IOL dislocation, which required repeated IOL exchange.

Five of the 35 eyes (14.3%) with implantation of the new IOL in the ciliary sulcus showed the following post-operative complications: three eyes (8.6%) with retinal detachment and 2 (5.7%) with development of the epiretinal membrane and subsequent peeling surgery.

Three of the 11 eyes (27.3%), with removal of the capsular bag and implantation of an iris claw lens, developed retinal detachment.

Fisher's exact test was used to examine the possible correlation between anterior vitrectomy and retinal detachment after IOL exchange, which showed no significance ($p = 0.669$).

Discussion

From the patient's perspective, the essential aspect of IOL explantation is recovery of vision diminished by IOL opacification. The exchange procedure significantly improved vision. Our findings corroborate the results of other investigations that have primarily observed successful visual recovery.[10–13] Noteworthy is that for patients with lens opacification, a loss of contrast sensitivity is often more incriminating than the measurable loss of BCDVA. One patient presented with a BCDVA of 0.1 logMar, but because of the advanced opacification of the lens, fundoscopy was not possible, and the patient felt severely handicapped.

Calcification is a late postoperative complication occurring from 16.27 ± 6.45 months up to 4 ± 1.2 years.[11,14–16] This long period until explantation results in firm IOL and capsular bag adhesions. Several studies have shown that in-the-bag placement is only possible in a minority of cases and that surgeons mostly prefer the ciliary sulcus[12,15,16] or using an iris-claw IOL.[3,10,16] In our patients, IOL exchange was performed at a mean interval of 42.5 months. This might have led to the high proportion of iris-claw and sulcus IOLs and necessitated anterior vitrectomy in 40% of the cases.

The strength of adhesion of the IOL haptic in the peripheral capsular bag depends on the lens design. A one-piece IOL with C-haptics, such as Lentis LS-502-1, develops relatively firm connections between haptics and the capsule, thus requiring more vigorous manipulations and bearing a higher risk of defects to the zonule apparatus. Three-piece IOLs with Prolene haptics or plate haptics can be easily separated from the capsule.

Regarding intraoperative difficulties, we observed zonular defects requiring completely removing the capsule in 22%, comparable to other studies in (23–40%).[12,17]

Our sample differed from those of other studies by a high proportion of patients who underwent initial phacovitrectomy, and this combined intervention bears a higher risk of zonular defects than phacoemulsification alone.[9]

We also found a high rate of central posterior capsular defects (29%), which could be linked to a previous YAG laser capsulotomy. Our rate of anterior vitrectomy (40%) was relatively high compared to other studies (8–23%),[12,15,17] while two more recent investigations presented similar rates of 31.8% and 64.8%.[10,13]

While most previous studies have focused on the intra- and early postoperative complications of IOL exchange,[18] we extended our investigation to any severe ophthalmic complications requiring surgical intervention and occurring late postoperatively.

Our study's rate of patients suffering from postoperative temporary CME was relatively low (4%) compared to previously published data (10–17%).[19,20] However, anterior vitrectomy (40%) and iris-claw lenses (23%) were performed in a high proportion.

Nine eyes required 11 surgical procedures for complications after IOL exchange. In 2 cases, the new IOL was dislocated. One patient (Case 1) with an intracapsular IOL experienced IOL dislocation shortly after IOL exchange and was successfully treated with repeated IOL exchange. During repeated IOL exchange, an iris claw lens was used to restore visual acuity fully. The other IOL dislocation (Case 2) occurred after surgery for RD; here, the iris-claw IOL could be refixated without replacing it.

The most common complication was RD, seen in six eyes (cases 2–7), occurring 1–34 months after IOL exchange, 4/6 within 6 months, and 5/6 within one year.

All 6 patients underwent anterior vitrectomy during IOL exchange due to vitreous prolapse. Vitreous prolapse is a known risk factor for complicated cataract surgery that significantly increases the risk of RD after cataract surgery.[21] During IOL exchange with an open posterior capsule or insufficient stability of the zonule, it is impossible to avoid touching the vitreous, increasing the risk for RD. Rosen et al suggested a timescale of one to three years for RD in eyes with predisposing comorbidities after lens surgery. This matches all cases of RD mentioned above.[22]

A complete posterior vitrectomy, including vitreous base shaving, was not performed.

It can, however, only be speculated that performing a complete vitrectomy in patients with vitreous prolapse may minimize the potential risk for retinal detachment development.

In eyes with a complete vitrectomy for posteriorly dislocated lens material after complicated cataract surgeries, the risk for developing retinal detachment seems lower than in eyes with anterior vitrectomy alone.[23]

One eye (case 7) developed a pupillary block with an iris-claw IOL after RD surgery with gas tamponade, which was successfully treated with inferior laser iridotomy.

Two eyes (cases 8 and 9) developed epiretinal gliosis in the macula 5 and 6 months after IOL exchange. Case 8 had a lamellar macular hole before, and Case 9 had undergone RD surgery, predisposing factors for epimacular membrane formation. However, cataract surgery is a known risk factor for the formation of epiretinal membranes, and irritation of the vitreous may further stimulate the proliferative response of glial cells on the central retina.[24]

Five out of nine patients were known to have some kind of ophthalmic comorbidity, which might have had predisposing effects, increasing the risk of complications.

Cases 1, 2, 4, and 7 had no such comorbidities; three of these eyes developed RD.

Several authors have not observed any severe complications after IOL exchange,[12,15] others did. Several studies have investigated complications after IOL exchange for various reasons.[25,26] The most frequent postoperative complications were cystoid macular edema, secondary glaucoma, IOL luxation, retinal detachment, corneal ulcers, corneal decompensation, and vitreous prolapse. Gurabardhi et al presented two explant cases out of 71 that showed serious complications after IOL exchange.[10] One of them also suffered from RD. Theoulakis et al observed one case of RD out of 55.[27]

Since the study was carried out over a long period, some modifications of the surgeries took place. In cases with vitrectomies, the vitrectomies were carried out as 23- or 25 Gauge vitrectomies. A tendency towards complete vitrectomies to prevent retinal detachments could be observed, as well as a trend towards larger corneoscleral tunnels with the explanation of the IOLs in one piece to avoid temporary corneal problems in the early postoperative course.

No other study has examined the complication rates after exchanging a specific opacified IOL type.

Conclusion

In most cases, exchanging opacified IOLs is safe for restoring disturbed vision in the hands of a well-experienced surgeon. Nonetheless, it can potentially cause severe sight-threatening complications even in eyes without predisposing ocular comorbidities.

Disclosure

Prof. Dr. Horst Helbig reports personal fees from Alcon, during the conduct of the study; personal fees from Novartis, Bayer Apellis AbbVie, Thea, outside the submitted work. The author reports no other conflicts of interest in this work.

References

1. Chan TCY, Lok JKH, Jhanji V, Wong VWY. Intraocular lens explantation in Chinese patients: different patterns and different responses. *Int Ophthalmol*. 2015;35(5):679–684. doi:10.1007/s10792-014-9996-7
2. Jones JJ, Jones YJ, Jin GJC. Indications and outcomes of intraocular lens exchange during a recent 5-year period. *Am J Ophthalmol*. 2014;157(1):154–162.e1. doi:10.1016/j.ajo.2013.08.019
3. Fernández-Buenaga R, Alió JL, Muñoz-Negrete FJ, Barraquer Compte RI, Alio-Del Barrio JL. Causes of IOL explantation in Spain. *Eur J Ophthalmol*. 2012;22(5):762–768. doi:10.5301/ejo.5000168
4. Jin GJC, Crandall AS, Jones JJ. Changing indications for and improving outcomes of intraocular lens exchange. *AJOPHT*. 2005;140(4):688–694.
5. Gartaganis SP, Prahs P, Lazari ED, Gartaganis PS, Helbig H, Koutsoukos PG. Calcification of Hydrophilic Acrylic Intraocular Lenses with a Hydrophobic Surface: laboratory Analysis of 6 Cases. *Am J Ophthalmol*. 2016;168:68–77. doi:10.1016/j.ajo.2016.04.018
6. Werner L. Causes of intraocular lens opacification or discoloration. *J Cataract Refract Surg*. 2007;33(4):713–726. doi:10.1016/j.jcrs.2007.01.015
7. Drimtzias EG, Rokidi SG, Gartaganis SP, Koutsoukos PG. Experimental investigation on mechanism of hydrophilic acrylic intraocular lens calcification. *Am J Ophthalmol*. 2011;152(5):824–33.e1. doi:10.1016/j.ajo.2011.04.009
8. Neuhann IM, Kleinmann G, Apple DJ. A new classification of calcification of intraocular lenses. *Ophthalmology*. 2008;115(1):73–79. doi:10.1016/j.ophtha.2007.02.016
9. Scherer NCD, Müller K, Prahs PM, Radeck V, Helbig H, Märker DA. Serial opacification of a hydrophilic-hydrophobic acrylic intraocular lens - analysis of potential risk factors. *J Cataract Refract Surg*. 2020;46(12):1624–1629. doi:10.1097/j.jcrs.0000000000000342
10. Gurabardhi M, Häberle H, Aurich H, Werner L, Pham D-T. Serial intraocular lens opacifications of different designs from the same manufacturer: clinical and light microscopic results of 71 explant cases. *J Cataract Refract Surg*. 2018;44(11):1326–1332. doi:10.1016/j.jcrs.2018.07.026
11. Costa JF, Bompastor-Ramos P, Marques M, et al. Large-scale opacification of a hydrophilic/hydrophobic intraocular lens. *Eur J Ophthalmol*. 2020;30(2):307–314. doi:10.1177/1120672119830581
12. Gashau AG, Anand A, Chawdhary S. Hydrophilic acrylic intraocular lens exchange: five-year experience. *J Cataract Refract Surg*. 2006;32(8):1340–1344. doi:10.1016/j.jcrs.2006.02.062
13. Fernández-Buenaga R, Alió JL, Pinilla-Cortés L, Barraquer RI. Perioperative complications and clinical outcomes of intraocular lens exchange in patients with opacified lenses. *Graefes Arch Clin Exp Ophthalmol*. 2013;251(9):2141–2146. doi:10.1007/s00417-013-2411-7
14. Werner L, Hunter B, Stevens S, Chew JJL, Mamalis N. Role of silicon contamination on calcification of hydrophilic acrylic intraocular lenses. *AJOPHT*. 2006;141(1):35–43.
15. Kim SM, Choi S. Clinical Efficacy and Complications of Intraocular Lens Exchange for Opacified Intraocular Lenses. *Korean J Ophthalmol*. 2008;22(4):228. doi:10.3341/kjo.2008.22.4.228
16. Vounotrypidis E, Schuster I, Mackert MJ, Kook D, Priglinger S, Wolf A. Secondary intraocular lens implantation: a large retrospective analysis. *Graefes Arch Clin Exp Ophthalmol*. 2019;257(1):125–134. doi:10.1007/s00417-018-4178-3
17. Dagres E, Khan MA, Kyle GM, Clark D. Perioperative complications of intraocular lens exchange in patients with opacified Aqua-Sense lenses. *J Cataract Refract Surg*. 2004;30(12):2569–2573. doi:10.1016/j.jcrs.2004.04.055
18. Hayashi K, Hirata A, Hayashi H. Possible predisposing factors for in-the-bag and out-of-the-bag intraocular lens dislocation and outcomes of intraocular lens exchange surgery. *Ophthalmology*. 2007;114(5):969–975. doi:10.1016/j.ophtha.2006.09.017
19. Davies EC, Pineda R. Intraocular lens exchange surgery at a tertiary referral center: indications, complications, and visual outcomes. *J Cataract Refract Surg*. 2016;42(9):1262–1267. doi:10.1016/j.jcrs.2016.06.031
20. Meyer LM, Philipp S, Fischer MT, et al. Incidence of cystoid macular edema following secondary posterior chamber intraocular lens implantation. *J Cataract Refract Surg*. 2015;41(9):1860–1866. doi:10.1016/j.jcrs.2015.10.024
21. Kim TY, Kang HG, Kim CY, Koh HJ, Kim SS, Kim M. Delayed vitreous prolapse after cataract surgery: clinical features and surgical outcomes. *Sci Rep*. 2021;11(1):16107. doi:10.1038/s41598-021-95527-0
22. Rosen E. Risk management for rhegmatogenous retinal detachment following refractive lens exchange and phakic IOL implantation in myopic eyes. *J Cataract Refract Surg*. 2006;32(5):697–701. doi:10.1016/j.jcrs.2006.03.012
23. Naderi K, Allen F, Dowlut S, Karia N, Chandra A. The risk of rhegmatogenous retinal detachment following anterior vitrectomy during cataract surgery: with versus without pars plana vitrectomy. *Graefes Arch Clin Exp Ophthalmol*. 2020;258(11):2425–2429. doi:10.1007/s00417-020-04843-0
24. Estafanous MF, Lowder CY, Meisler DM, Chauhan R. Phacoemulsification cataract extraction and posterior chamber lens implantation in patients with uveitis. *Am J Ophthalmol*. 2001;131(5):620–625. doi:10.1016/S0002-9394(00)00909-0
25. Goemaere J, Trigaux C, Denissen L, et al. Fifteen years of IOL exchange: indications, outcomes, and complications. *J Cataract Refract Surg*. 2020;46(12):1596–1603. doi:10.1097/j.jcrs.0000000000000349
26. de Rojas MV, Viña S, Gestoso A, Simón P, Álvarez M. Intraocular lens explantation in Spain: indications and outcomes at a tertiary referral center from 2010 to 2018. *Int Ophthalmol*. 2020;40(2):313–323. doi:10.1007/s10792-019-01181-x
27. Theoulakis PE, Brinkmann CK, Petropoulos IK, Gatzogias MI, Katsimpris JM. Hydrogel intraocular lens exchange: five-year experience. *Klin Monbl Augenheilkd*. 2009;226(4):254–257. doi:10.1055/s-0028-1109302