Iris Suture-Fixed Intraocular Lens Surgery as the Primary Preference in Aphakic Patients Without Capsular Support: Complications and Long-Term Results

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ABSTRACT

Purpose: To evaluate the visual outcomes and complications of a foldable acrylic intraocular lens (IOL) sutured to the iris through a small incision as a primary option in aphakic patients without capsular support.

Methods: Iris-sutured PC IOL operations performed at Giresun University Faculty of Medicine, Giresun Training and Research Hospital Ophthalmology Clinic between January 2017 and May 2023 were examined retrospectively. The study included thirty-six eyes from 32 patients who had foldable acrylic IOL implantation using peripheral iris-sutured due to aphakia in the absence of capsule support. We aimed to evaluate patients who could not place an IOL for any reason during cataract surgery, who underwent iris-sutured PC IOL surgery at least two months after cataract surgery, and who were followed up for at least one year.

Results: A total of 36 eyes of 32 patients were included. Mean overall follow-up was 9.5±3.56 months (range 6-54 months). There was an overall improvement in best-corrected visual acuity from mean preoperative logMAR 1.02±0,60 to postoperative logMAR 0,23±0,05. While the preoperative average astigmatic error was 1.72±0.55D, the postoperative average astigmatic error was 1.69±0.87D (p=0.512). Complications of intraocular surgery with iris fixation with sutures included transient low-grade uveitis (4 eyes [11%]), IOL dislocation (1 eye [3%]), retinal detachment (3 eyes [8%]), early cystoid macular edema (CME) (7 eyes [19%]), late CME (4 eyes [11%]), and bullous keratopathy (1 eye [3%]). Endophthalmitis was not observed in any patient.

Conclusion: In the absence of capsule support, small-incision peripheral iris-sutured of 3-piece acrylic foldable IOL appears to be an effective and safe technique.

Keywords: Aphakia, Iris-sutured posterior chamber IOL, Absence of capsule support, Secondary IOL implantation

INTRODUCTION

Phacoemulsification is one of the most common surgeries worldwide.[1] Although surgical complications are rare, aphakia and improperly positioned intraocular lenses (IOL) without capsular support represent a clinical problem and surgical challenge. Surgery techniques commonly used to treat aphakia and malpositioned IOL include anterior chamber (AC) IOL, posterior chamber (PC) trans-scleral sutured IOL, and PC iris-sutured IOL.[2] The surgeons experience with the specific technique is usually the deciding factor when it comes to choosing surgical treatment for secondary IOL without capsular support. Although the complications differed, a meta-analysis study found no evidence of superiority between these options.[3] Although AC IOL designs have improved significantly and are easier to implant, they can cause corneal decompensation, trabecular meshwork damage, and chronic inflammation.[4-5] There is a lower chance of corneal endothelial damage with the PC IOL because it is placed closer to a physiological position and farther away from the cornea.[6] One of the

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main criticisms of sutured PC IOL is late IOL dislocation due to tissue erosion.[7] Late endophthalmitis risk may also be raised by tissue erosion resulting from the suture being exposed through the conjunctiva.[8]

Iris-sutured PC IOL has some advantages over transscleral-sutured PC IOL. Since the surgical procedure is more technically simple to perform, it requires less surgical time. Iris-sutured PC IOL carry the risk of postoperative inflammation (CME, uveitis), iris atrophy, and pigment dispersion syndrome. In contrast, a transsclerally sutured PC IOL does not contact the iris when properly secured. Therefore, there is less risk of iris atrophy associated with pigment dispersion, CME, or chronic uveitis. However, transsclerally sutured PC IOL are generally more technically difficult to implant and require longer operating times. This increases the risk of intraoperative suprachoroidal bleeding and postoperative inflammation or infection.[9]

In this study, we aimed to retrospectively evaluate patients we could not place an IOL for any reason during cataract surgery, who underwent iris-sutured PC IOL surgery at least two months after cataract surgery, and who were followed up for at least one year.

MATERIALS AND METHOD

The study was carried out in accordance with the principles of the Declaration of Helsinki. Informed consent forms were obtained from all patients participating in the study. The iris-fixed IOL operations performed at the Giresun University Faculty of Medicine Giresun Training and Research Hospital Ophthalmology Clinic between January 2017 and May 2023 were evaluated retrospectively after the necessary permissions and ethical approvals were obtained from the local ethics committee (IRB 2023-11-20/1). The study included patients who could not have an IOL implanted for any reason during cataract surgery, underwent iris-sutured PC IOL surgery at least two months after cataract surgery, and were followed up on for at least one year. Files of patients who had previously undergone glaucoma, vitreoretinal, or corneal surgery were not included in the study. In addition, the files of patients who did not have data on the preoperative, postoperative first day, and postoperative 8–10 week controls were excluded from the study.

Surgical Procedure

All surgeries were performed by the same surgeon. All secondary IOL surgeries used MA50BM Alcon lenses. Before starting the operation, the scleral port was opened at the 5 o'clock position. Then, limbal paracentesis was performed with an MVR blade at the nine o'clock position in the right eye and three o'clock position in the left eye, and the main entrance was opened with a 2.2 mm knife at the 11-12 o'clock position. (The main entrance was revised according to the status of the astigmatic axis.) If necessary, a vitrectomy was performed in the pupillary space with the help of an anterior vitrector. After one haptic of the lens was placed in the posterior chamber, the optical part was placed on the iris, and the other haptic was placed in the posterior chamber under the iris. A 10-0 prolene suture (CIF-4; Ethicon, Somerville, NJ) was entered through the 11-12 o'clock main entrance. The posterior chamber was entered transirideally, just in front of the haptic. Immediately afterwards, the clear cornea was exited by passing to the anterior chamber. Afterwards, the sutures were tied, and the same process was repeated for the other haptic from the main port. Finally, the operation was terminated after the optic was transferred to the posterior chamber and the scleral port was sutured with 8/0 Vicryl (Polyglactn 910, Ethicon, Somerville, NJ). (Figure 1)

Parameters

Demographic data of the patients, surgery date, age, and anesthesia type were noted. Spherical equivalent, corneal astigmatism, intraocular pressure (IOP), anterior chamber depth (ACD), central corneal thickness (CCT), and best-corrected visual acuity (BCVA) values were recorded at preoperative, first postoperative day, and postoperative 8–10 week follow-up visits. All complications occurring during the one-year follow-up were taken from the files. A statistical analysis of the received data was performed. Autorefractor keratometer (Topcon Auto Ref-Keratometer, Tokyo, Japan) in the evaluation of spherical equivalent and corneal astigmatism, Goldmann applanation tonometer in measuring intraocular pressure, optical biometry (Topcon Aladdin Optical Biometry, Japan) in evaluating the anterior chamber depth, and specular microscopy (Topcon SP-1P-Japan) in determining the central corneal thickness were used.

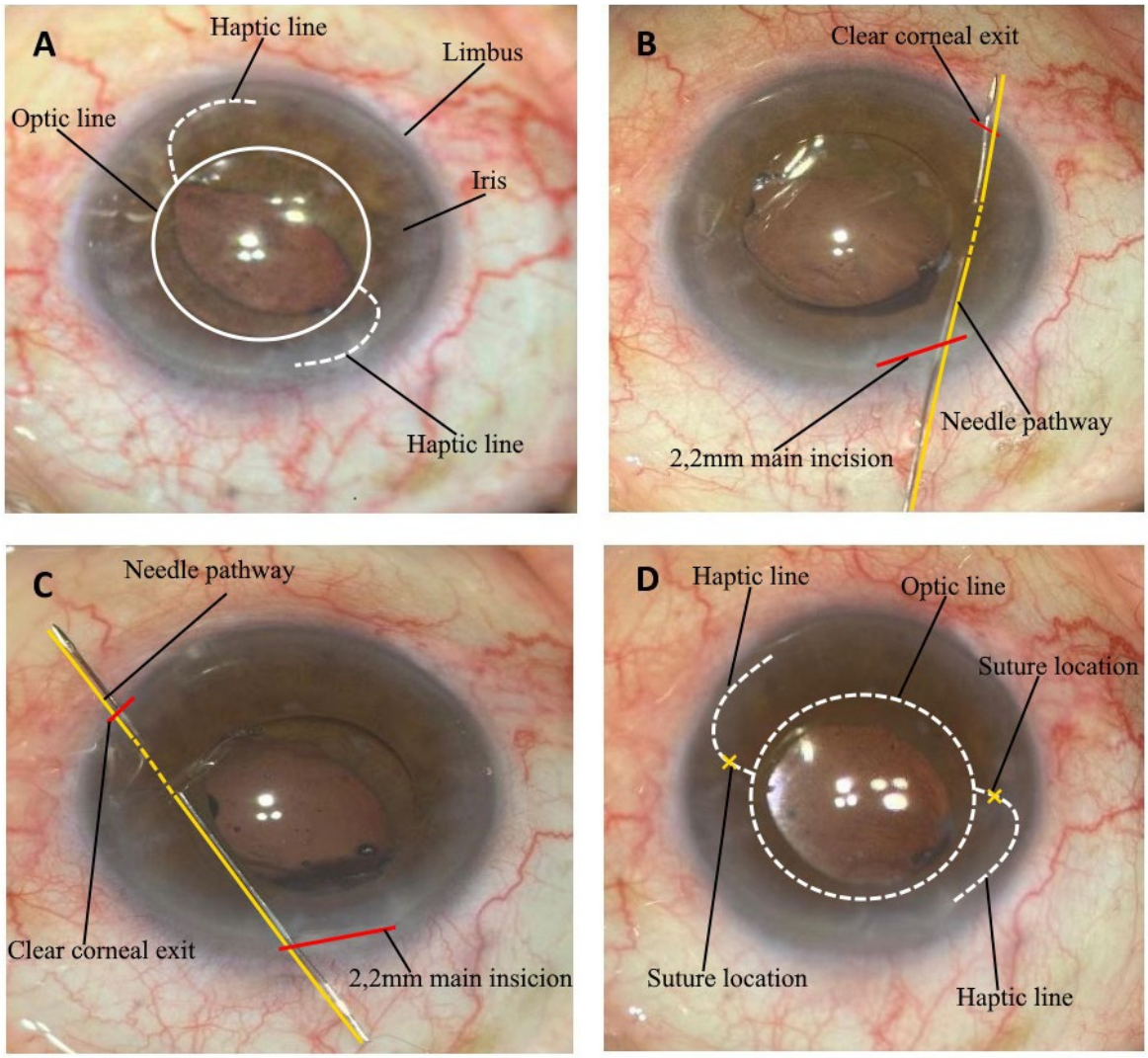

Figure 1. ***A.*** *View after the haptics of the intraocular lens are placed on the posterior iris* ***B-C.*** *10/0 nylon suture passing under the haptic and exiting the limbus* ***D.*** *Image after posterior iris placement of the intraocular lens*

Statistical analysis

After compatibility with the normal distribution of the study data had been confirmed with the Kolmogorov-Smirnov test, statistical calculations between two dependent groups were performed using the t test. P values < 0.05 and < 0.001 were regarded as statistically significant. These analyses were conducted with the SPSS software, version 22.0 (SPSS Inc., Chicago, IL).

RESULTS

Thirty-six eyes of 32 patients with secondary IOL implantation as a primary option were evaluated retrospectively. The demographic data of the patients and the type of anesthesia are summarized in Table 1. The SE value, which was 11.45±3.26 D before the surgery, was found to be -0.95±0.57 D and -1.02±0.48 D on the first

Table 1. *Demographics, baseline charecteristics and type of anesthesia*

N (Patients/eyes)	32/36
Right/Left	20/16
Female/Male	18/14
Time since cataract surgery (years) mean±SD **Range**	2,32 ±1,67 0,3-5.5
Follow-up time after fixation surgery (months) mean±SD **Range**	9,5±3,56 6-54
Age at fixation (years) mean±SD **Range**	56.24±15.65 16-81
Retrobulbar/General anesthesia	30/6

postoperative day and in the second month, respectively (p = 0.0000). There was no statistically significant difference in astigmatism values before and after surgery. The mean intraocular pressure value obtained in the second postoperative month was found to be statistically lower than the preoperative and postoperative first days (preoperative, 17.22±9.76; postoperative first day, 18.45±11.55; and postoperative second month, 15.87±6.65 $P^{1,2}<0.05$). In anterior chamber depth measurements, the preoperative mean (3.06±0.86 mm) was found to be lower than both the first day (3.75±1.03 mm) and second month (3.64±1.17 mm) values. ($P^{1} <0.05$). BCVA value was 1,02±0,60 LogMAR preoperatively, 0,31±0,13 LogMAR on the first postoperative day, and 0,23±0,05 LogMAR on the second month postoperatively. The postoperative mean BCVA value was found to be statistically significant compared to the preoperative mean BCVA value. Preoperative and postoperative values are summarized in Table 2. Five eyes (13%) experienced anterior chamber bleeding during surgery, which was treated with perioperative anterior chamber lavage and did not cause any complications in the postoperative period. The patient had vitreous hemorrhage originating from the iris root, and the vitreous hemorrhage spontaneously regressed at his second-month visit. The IOL was dislocated or subluxed in four eyes (11%) as a result of the unraveling of the sutures placed on the iris, and the IOL was corrected and re-sutured. At the first postoperative visit, a suture-induced dislocation was detected in one eye, who was taken to surgery again and corrected. CME was detected in seven eyes during the first week to first month of postoperative visits. Two eyes improved with topical treatment. After applying subtenon triamcinolone acetate to five eyes, there was improvement in all patients. However, CME recurred in four eyes in the late postoperative period. Intravitreal bevacizumab and subtenon triamcinolone acetate were used to achieve remission in these eyes. One eye had corneal edema, which we thought was due to a sudden IOP elevation during surgery. The surgery continued after the corneal edema resolved with intravitrenous mannitol treatment. Although corneal edema occurred in nine eyes in the early postoperative period, corneal edema was relieved in eight eyes with topical treatments. One eye, whose late postoperative edema persisted, was referred to a center with a cornea unit. Vitreoretinal surgery was performed due to rhegmatogenous retinal detachment that occurred in three eyes in the late postoperative period. The recorded intraoperative and postoperative complications of the patients are summarized in Table 3.

Table 2. *Changes in parameters among preoperative and postoperative measurements*

	Before surgery	**First day after surgery**	**Second month after surgery**	**p**
SE, mean±SD **Range(D)**	11.45±3,26 6.25-14.75	-0,95±0,57 (-1,75) -(1,50)	-1,02±0,48 (-2,25) -(1,25)	*P^{1} =0.0000* *P^{2}=0.0000* *P^{3}=0.302*
Corneal astigmatism, mean±SD **Range (D)**	1,72±0,55 0,12-4,75	2,02±1,07 0.75-5,50	1,69±0,87 0.5-4.25	*P^{1} =0,475* *P^{2}=0,512* *P^{3}=0.296*
IOP, mean±SD **Range(mmHg)**	17.22±9,76 9.6-44.75	18.45±.55 7.2-36.8	15.87±6,65 9,98-21.4	*P^{1} =0.113* *P^{2}<0.05* *P^{3} <0.05*
ACD mean±SD **Range(mm)**	3,06±0,86 2,74-4,25	3,75±1,03 2,9-4,57	3,64±1,17 2,88-4,35	*P^{1} <0.05* *P^{2} <0.05* *P^{3}=0.601*
CCT mean±SD **Range(µm)**	551,5±122,7 457-612	587.1±224,8 468-657	557,9±189,5 461-658	*P^{1} =0.551* *P^{2}=0.059* *P^{3}=0.401*
BCVA(logMar) mean±SD **Range**	1,02±0,60 0,91-0,68	0,31±0,13 0,22-0,88	0,23±0,05 0,1-0,57	*P^{1} <0.05* *P^{2}<0.05* *P^{3}=0.194*

SE, spherical equivalent; IOP, intraocular pressure; ACD, anterior chamber depth; CCT, central corneal thickness; BCVA, best corrected visual acuity; D, diopter, mmHg, milimeter of mercury; mm, milimeter. P^{1}, before surgery vs first day; P^{2}, before surgery vs second month; P^{3}= first day vs second month.

Table 3. *Frequency of recorded intraoperative and postoperative complications*

N=36 eye	Intraoperative	Early postoperative	Late postoperative
Anterior chamber hemorrhage	5 (%13)	0	0
Vitreous hemorrhage	1 (%3)	1 (%3)	1 (%3)
IOL drop	0	0	0
S-IOL, D-IOL	4 (%11)	1 (%3)	0
CME	-	7 (%19)	4 (%11)
Corneal edema	1 (%3)	9 (%25)	-
Bullous keratopathy	-	-	1 (%3)
Endophthalmitis	-	0	0
Uveitis	-	4 (%11)	0
Glaucoma/OHT	-	4 (%11)	1 (%3)
Retinal detachment	-	0	3 (%8)

IOL, Intraocular lens; S, Subluxated; D, dislocated; CME, Cystoid macular edema; TASS, Toxic anterior chamber syndrome; OHT, Ocular hypertension.

DISCUSSION

Aphakia and the absence capsule support are challenging situations for ophthalmic surgeons. IOL selection and the IOL implantation method for correcting aphakia in eyes without capsule support are still debated. A review by the American Academy of Ophthalmology finds that there is insufficient evidence to demonstrate the superiority of any type of surgery or site of IOL fixation over another.[2] Schein et al. compared three different IOL fixation strategies in IOL implantation surgery performed simultaneously with penetrating keratoplasty, and no difference was detected in terms of visual outcome.[10] Therefore, there is no single surgical treatment option for all cases; the appropriate surgery should be selected in the appropriate case.

Although AC IOL are easy to implant, they can cause endothelial decompensation or secondary glaucoma.[4-5] To prevent IOL rotation, corneal contact, iris entrapment, and chronic inflammation, the AC angle width must be correctly sized. Traditionally, surgeons have used a one mm corneal white-to-white measurement as a guide to determine the correct AC IOL size. However, recent imaging studies with high-speed optical coherence tomography have revealed that this method has a lack of correlation and is relatively inaccurate, thus creating uncertainty regarding AC IOL implantation.[11] Since current AC IOL are not foldable, most require a relatively large incision of at least six mm.

Sclerally sutured sulcus PC IOL implantation, although technically more challenging, has the advantages of avoiding some of the angle-related and sizing issues with AC IOL. PC IOL implantation fixed to the scleral sulcus has risks such as bleeding, suture extrusion, endophthalmitis, anterior synechiae, and IOL bending.[12]

Iris-sutured PC IOL has certain advantages over transsclerally-sutured PC IOL. Because the procedure is generally simpler to perform, it requires less surgical time and avoids transscleral external suture-related complications.

Although the use of a polypropylene suture in the technique of fixing the PC IOL to the iris makes a significant contribution to long-term IOL stability, it should be known that it may cause pigment dispersion or uveitis-glaucoma-hyphema syndrome.[13]

Condon et al., patients who could not place an IOL for any reason during cataract surgery, who underwent iris suture IOL surgery at least two months after cataract surgery, and who were followed up for at least 12 months were evaluated retrospectively. We chose iris-sutured PC IOL surgery as the primary surgery because it is relatively easier to perform than other secondary IOL surgeries and the IOL is located posteriorly. This study contributes to the existing literature on early and late complications of iris-sutured PC IOL surgery.

In the study, 46 patients without capsule support who

underwent peripheral iris fixation with a three-piece acrylic foldable IOL were evaluated retrospectively. Forty-four of 46 patients (95.7%) maintained or improved their best-corrected visual acuity (BCVA). Two patients lost BCVA due to bullous keratopathy and epiretinal membrane formation, respectively. After surgery, 32 of 46 eyes (69.6%) achieved a BCVA of better than 20/40, and 41 of 46 eyes (89.1%) achieved a BCVA of 20/80 or better.[14] Hoh et al. reported an increase in VA after iris suture fixation of a 7-mm 2-hole optical IOL in 27 of 30 eyes without any major complications.[15] Navia-Aray reported that a VA of 20/40 or better was achieved in 19 of 30 cases using a limbal approach with a specially designed rigid four-hole optical PC IOL and that there were no serious anterior segment complications in any of the cases.[16] In our study, the average BCVA value of 36 eyes of 32 patients was 0.23±0.05 LogMAR. One patient was referred to the cornea unit for keratoplasty due to bullous keratopathy, and three patients underwent vitreoretinal surgery due to developing retinal detachment.

Garcia-Rojas et al. reported that the clinical results of 30 eyes in which a three-piece IOL was placed through a corneal incision and the haptics were fixed with sutures to the iris were good, and the IOL was not dislocated to the vitreous or retina.[17] Soiberman et al. reported a study of 27 eyes with iris sutures and PPV, reporting low surgically induced astigmatism and stable positioning of the IOL.[18] In our study, corneal astigmatism was measured as 1.72±0.55 D before surgery and 1.69±0.87 D after surgery, and no statistically significant difference was detected. Dislocation due to early suture unraveling was observed in only one patient, and the subluxated IOL was corrected and re-sutured to the iris. No subluxation or dislocation was observed in the late period. According to the results of these studies, IOL implantation in the iris suture is safe and successful in terms of IOL stabilization and not causing any change in corneal astigmatism.

Condon et al. reported that three (6.5%) of their peripheral iris-fixated IOL patients developed mild and prolonged uveitis that resolved with topical steroids. Three (6.5%) patients developed pigment dispersion, and one of them developed high intraocular pressure (IOP), which was controlled with topical antiglaucoma medications. He reported that no new CME cases were observed.[14] Michaeli et al. reported that seven (15.9%) new cases of glaucoma developed after iris-sutured IOL surgery.[19] A different study demonstrated mean IOP normalization following iris fixation in five eyes with PXF.[20] In our study, CME developed in seven patients in the early period and in four patients in the late period, and remission was achieved with appropriate treatments. IOP elevation was observed in the early period in four patients and in the late period in only one patient. The patient, who had a late IOP increase, was controlled with topical antiglaucomatous treatment. A decrease in mean IOP was also observed after surgery, which we think may be due to the increase in anterior chamber depth.

Vural et al. reported retinal detachment in 6.7% and cystoid macular edema in 3.3% of patients who underwent secondary intraocular lens implantation with the Yamane technique. In addition, preoperative BCVA value was 0.25 ± 0.22 and postoperative BCVA value was 0.49 ± 0.24.[21] Özkaya et al. showed that retinal detachment developed in 4% and cystoid macular edema in 4% of patients who underwent secondary IOL implantation with scleral fixation technique. The preoperative BCVA value was 0.03 (0.001- 0.4) and the postoperative BCVA value was 0.4 (0.001- 1.0).[22] Although the rate of retinal detachment in intraocular lens surgery fixed to the iris with sutures seems to be high in our study, two of the patients with retinal detachment were actually patients who were admitted to our clinic for secondary intraocular lens surgery for aphakia approximately six months after cataract surgery in an outside center. The common feature of these patients was that the anterior vitreous was not adequately cleared. It is seen that CME rates of iris suture-fixed intraocular lens surgery are similar to other secondary IOL surgical techniques. In our study, the preoperative BCVA was Logmar 1.02±0.60 and the postoperative BCVA was Logmar 0.23±0.05. According to the results of our study, the postoperative visual acuity of intraocular lens surgery with suture fixation to the iris seems to be slightly better than other secondary IOL surgeries. The patient who developed bullous keratopathy was a patient who developed intraoperative large descement detachment during cataract surgery performed in an external center and received long-term medical treatment. We think that bullous keratopathy developed due to this reason. In addition, intraocular lens surgery with suture fixation to the iris was performed in both

eyes of four patients. All of these patients had undergone bilateral cataract surgery approximately 15-20 years ago and were wearing glasses with aphakic correction.

The iris-sutured PC IOL technique has significant advantages over other secondary IOL surgeries: easy surgery, low astigmatism due to the small incision, favorable anatomical lens position, absence of conjunctival (erosion, thinning), and scleral complications (suture exposure, haptic exposure, scleral thinning).

Our study is limited due to its retrospective design. Although patients were followed for at least 12 months, more data are needed to determine long-term effectiveness and safety. Additionally, patients who were more likely to benefit from iris fixation were included in this study. It is important to note that no patient had significant iris abnormalities or large iris defects that would contraindicate iris suture fixation.

In summary, our mid-term results with an average follow-up of one year demonstrated successful visual outcomes and safety with iris-sutured foldable acrylic lenses. In comparison to scleral fixation of AC IOL or PC IOL in aphakia, we believe that iris suture fixation technique provides an optimal balance of technical convenience, small incision, appropriate anatomical lens location, increased safety margin, and successful visual rehabilitation. However, this surgical strategy can be personalized. Age, corneal status, angle structures, iris anatomy, and glaucoma are important considerations in selecting candidates for the appropriate IOL fixation method. It has become our primary method of detection in aphakia, where there is no capsule support. Despite our experience with peripheral iris suture fixation, longer-term follow-up is needed to evaluate the longevity of the fixation and late complications.

DISCLOSURE STATEMENT

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

All data supporting the findings of this study are available from the corresponding author, Hakan Koc, upon request.

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REFERENCES

1. Ma C, Hall G, Heath H et al. “Community Supporting Vision 2020 : The Right To Sight Technology For Vision 2020,” Community Eye Heal. J., 2002.
2. Wagoner MD, Cox TA, Ariyasu RG, Jacobs DS, Karp CL, American Academy of Ophthalmology. Intraocular lens implantation in the absence of capsular support: a report by the American Academy of Ophthalmology. Ophthalmology. 2003;110(4):840-59.
3. Li X, Ni S, Li S, Zheng Q, Wu J, Liang G, Xu W. Comparison of Three Intraocular Lens Implantation Procedures for Aphakic Eyes With Insufficient Capsular Support: A Network Meta-analysis. Am J Ophthalmol. 2018 Aug;192:10-19.
4. Lyle WA, Jin JC. Secondary intraocular lens implantation: anterior chamber vs posterior chamber lenses. Ophthalmic Surg. 1993 Jun;24(6):375-81.
5. Hennig A, Evans JR, Pradhan D, Johnson GJ, Pokhrel RP, Gregson RM, Hayes R, Wormald RP, Foster A. Randomised controlled trial of anterior-chamber intraocular lenses. Lancet. 1997 Apr 19;349(9059):1129-33
6. Soong HK, Meyer RF, Sugar A. Techniques of posterior chamber lens implantation without capsular support during penetrating keratoplasty: a review. Refract Corneal Surg. 1989 Jul-Aug;5(4):249-55.
7. Lane SS, Lubniewski AJ, Holland EJ. Transsclerally sutured posterior chamber lenses: improved lens designs and techniques to maximize lens stability and minimize suture erosion. Semin Ophthalmol. 1992 Dec;7(4):245-52
8. Walter KA, Wood TD, Ford JG, Winnicki J, Tyler ME, Reed JW. Retrospective analysis of a novel method of transscleral suture fixation for posterior-chamber intraocular lens implantation in the absence of capsular support. Cornea. 1998 May;17(3):262-6.
9. Mandelcorn ED, Prenner J, Wykoff CC, Lakhanpal RR, Albini T. IOL Fixation Techniques. Retin Today. 2010;(November):44–8.
10. Schein OD, Kenyon KR, Steinert RF, Verdier DD, Waring GO 3rd, Stamler JF, Seabrook S, Vitale S. A randomized trial of intraocular lens fixation techniques with penetrating keratoplasty. Ophthalmology. 1993 Oct;100(10):1437-43.
11. Goldsmith JA, Li Y, Chalita MR, et al. Anterior chamber width measurement by high-speed optical coherence tomography. Ophthalmology 2005;112:238 – 44.
12. Assia EI, Nemet A, Sachs D. Bilateral spontaneous subluxation of scleral-fixated intraocular lenses. J Cataract Refract Surg. 2002 Dec;28(12):2214-6.
13. Siegel MJ, Condon GP. Single suture iris-to-capsulorhexis

fixation for in-the-bag intraocular lens subluxation. J Cataract Refract Surg. 2015 Nov;41(11):2347-52.

14. Condon GP, Masket S, Kranemann C, Crandall AS, Ahmed II. Small-incision iris fixation of foldable intraocular lenses in the absence of capsule support. Ophthalmology. 2007 Jul;114(7):1311-8.
15. Höh H, Ruprecht K, Nikoloudakis N, Palmowski A. Preliminary results following implantation of iris-suture-fixated posterior-chamber lenses. Ger J Ophthalmol. 1993 Apr;2(2):70-5.
16. Navia-Aray EA. Suturing a posterior chamber intraocular lens to the iris through limbal incisions: results in 30 eyes. J Refract Corneal Surg. 1994 Sep-Oct;10(5):565-70.
17. Garcia-Rojas L, Paulin-Huerta JM, Chavez-Mondragon E, Ramirez-Miranda A. Intraocular lens iris fixation. Clinical and macular OCT outcomes. BMC Res Notes. 2012 Oct 10;5:560.
18. Soiberman U, Pan Q, Daoud Y, Murakami P, Stark WJ. Iris suture fixation of subluxated intraocular lenses. Am J Ophthalmol. 2015 Feb;159(2):353-9.
19. Michaeli A, Soiberman U, Loewenstein A. Outcome of iris fixation of subluxated intraocular lenses. Graefes Arch Clin Exp Ophthalmol. 2012 Sep;250(9):1327-32.
20. Shingleton BJ, Yang Y, O'Donoghue MW. Management and outcomes of intraocular lens dislocation in patients with pseudoexfoliation. J Cataract Refract Surg. 2013 Jul;39(7):984-93.
21. Sahin Vural G, Guven YZ, Karahan E, Zengin MO. Long term outcomes of Yamane technique in various indications. European Journal of Ophthalmology. 2023;33(6):2210-2216.
22. Özkaya D, Karaca U, Sofu G, Avcı M, Ertuğrul A. Evaluation of the postoperative outcomes of patients with scleral-fixated intraocular lens implantation. J Glaucoma Cataract. 2022;17(3):129.