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ORIGINAL ARTICLE

Comparison of anterior and posterior chamber implantation of iris claw lens in corneal transplant patients

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Abstract

Purpose: This study aims to compare the surgical outcomes of anterior chamber (AC) and posterior chamber (PC) implantation of iris claw lens (ICL) combined with penetrating corneal transplantation (P-CT), in eyes with no capsular support.

Methods: The records of 20 P-CT cases who underwent ICL implantation were retrospectively evaluated. The eyes were grouped according to the location of implantation; AC ICL and PC ICL. Pre- and post-surgical best-corrected visual acuity (BCVA), post-operative complications, and graft rejection rates were compared between the two groups. Mean follow-up time was 28 (range, 12 and 76) months.

Results: ICLs were implanted during P-CT surgery in 14 (70%) eyes and as a secondary procedure after P-CT in 6 (30%) eyes. ICLs were implanted in PC in 12 (60%) and in AC in 8 (40%) eyes. Mean pre-operative BCVA was 0.064 (range, 0.001–0.02) in the PC group and 0.02 (range, 0.001–0.1) in the AC group (p=0.86). Mean post-operative BCVA was 0.17 (range, 0.0001–1.0) in the PC group and 0.14 (range, 0.0001–0.4) in the AC group (p=0.81). Glaucoma developed in 5 (41.6%) eyes with PC ICL. No eye with AC ICL developed glaucoma overtime.

Conclusion: Both AC and PC ICL implantations provide favorable visual outcomes and complication rates in CT patients. However, PC implantation of ICL seems to increase glaucoma incidence.

Keywords: Aphakia; complication; corneal transplant; glaucoma; iris claw lens; keratoplasty.

In eyes with dislocated posterior chamber (PC) intraocular lens (IOL) or aphakia, it is desirable to leave the eye pseudophakic during corneal transplant, considering the optical advantages of IOLs. However, capsular or zonular insufficiency is a frequent problem in these eyes. Therefore, PC IOL implantation during penetrating corneal transplant (P-CT) can be a challenge for the surgeon. Iris-supported (e.g., iris claw) anterior chamber (AC) or iris fixated PC IOLs are some of the various options for IOL implantation in these eyes.[1,2]

The iris claw lens (ICL) was designed by Worst, for attachment to the anterior iris in eyes without capsular support.[3] However, significant complications such as damage to corneal endothelium, particularly in patients with narrow AC and corneal grafts, were observed over time. Hence, this technique was modified by Brasse and Neuhann, by

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clipping the lens to the posterior iris, with the A-constant altered according to 117.0.[4]

The purpose of this study is to compare the outcomes of AC and PC implantation of ICL in P-CT cases.

Materials and Methods

A retrospective chart review of P-CT cases who underwent ICL implantation between 2005 and 2012 in Ege University Hospital was performed. Approval for data collection and analysis was obtained from the Institutional Review Board at Ege University and was conducted according to the principles set forth in the Declaration of Helsinki.

Patients with previous glaucoma diagnosis, posterior segment, or optic nerve diseases that may reduce visual acuity were excluded from the study. The eyes were grouped according to the location of implantation; AC ICL and PC ICL.

Best-corrected visual acuity (BCVA) was tested using the Snellen chart at a distance of 6 m. Intraocular pressure (IOP) was measured with Goldman applanation tonometer (Haag-Streit, Bern, Switzerland). Pre- and post-surgical BCVA, post-operative complications including glaucoma development, and graft rejection rates were compared between two groups.

Surgical Technique

The pupil was not dilated or constricted before the surgery. Patients received local or general anesthesia. All donor corneas were excised from the endothelial side using a Troutman corneal punch and a disposable trephine. The donor tissue ranged from 7.75 to 8.25 mm in diameter and was always 0.25 mm larger than the recipient bed. A Hessburg Barron (JedMed Instrument Co., St. Louis, Missouri, USA) suction trephine (7.50–8.0 mm) was used for full-thickness trephination of the host cornea. The excision was then completed for 360° with corneal scissors. After removing the cornea of the recipient, if the eye was pseudophakic, the IOL was carefully removed. Unless already performed in an earlier operation, anterior vitrectomy was performed. Any visible peripheral synechiae were carefully lysed. In phakic recipient eyes with insufficient capsular or zonular support, anterior vitrectomy was also combined with crystalline lens aspiration.

IOL Implantation

In all cases, non-foldable ICLs (Artisan Aphakia, Ophtec, USA) were implanted.

For AC implantation, the IOL was centered in the AC and mid-peripheral iris was grasped with a specially designed, angled forceps. The claws were depressed over the forceps so that the claws enclaved the iris. The same maneuver was repeated for the other haptic.

For PC implantation, specifically designed lens holder forceps were used to grab and guide the IOL posteriorly through the pupil in an upside down position. The IOL was centered, and the mid-peripheral iris was pushed into the claw haptics using a spatula or a Sinskey hook.

Corneal tissue was stored in minimum essential medium. The donor cornea was placed over the recipient bed and sutured into position with interrupted 10–0 monofilament sutures.

Secondary ICL implantation was performed through clear corneal incision under viscoelastic protection as was described above. A peripheral iridectomy was performed in every patient. The optic power was calculated using the SRK II formula. The manufacturer's recommendation for anterior fixation is 115.0. We assumed a surgeon's factor A constant of 118.0 for posterior fixation. IOL calculations were performed for all patients before surgery.

Postoperatively, topical 0.1% dexamethasone (Maxidex, Alcon, USA) eye drops and 0.3% tobramycin (Tobrex, Alcon, USA) eye drops were instilled at 6 h intervals. Tobramycin drops were stopped whenever the epithelization is completed. Prednisolone acetate drops were tapered slowly and stopped after 3 months of use. Topical corticosteroid treatment was continued with a safe steroid such as fluorometholone (Flarex, Alcon, USA) for at least 12 months.

Glaucoma Diagnosis

Secondary glaucoma was defined as the persistence of increased IOP (>21 mmHg) 1 month after PK, in the presence of glaucomatous optic disc changes with increased CDR (cup to disc ratio) and/or detectable glaucomatous visual field defects such as nasal step, paracentral scotoma, or arcuate defect.[5–7]

Statistical Analysis

Statistical analysis was performed with SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). All data were reported as averages ± standard deviations. Statistical analysis for BCVA and IOP was performed using paired sample t-test and – to compare the two groups – independent samples t-test. For graft rejection rates, independent samples t-test was used. P=0.05 or less was considered statistically significant.

Results

Twenty eyes of 20 patients (12 males and 8 females) were included in the study. The mean age at the time of surgery was 62.8±17.6 (range, 23–89). The most common indication for P-CT was bullous keratopathy (14 [70%] eyes). Among bullous keratopathy eyes, 9 (64.3%) were pseudophakic, 4 (28.6%) were aphakic, and 1 (7.1%) was phakic. Other keratoplasty indications were keratoconus in 2 (10%) eyes, corneal opacity due to previous penetrating injury in 2 (10%) eyes, and corneal opacity due to herpetic keratitis in 2 (10%) eyes (Table 1). ICL implantation was performed as a combined procedure with PKP in 14 (70%) eyes; 7 (50%) pseudophakic eyes as IOL exchange due to pseudophakic bullous keratopathy, 3 (21.4%) phakic eyes with capsular insufficiency, and 4 (28.6%) aphakic eyes. The ICL implantation was performed as a secondary procedure in 6 (30%) eyes; 2 (33.3%) pseudophakic eyes as IOL exchange, 3 (50%) phakic eyes with capsular insufficiency, and 1 (16.7%) aphakic eye. ICLs were placed in PC in 12 (60%) and in AC in 8 (40%) eyes.

The post-operative BCVA (mean 0.16±0.07) of all eyes improved significantly (p<0.05), compared to the pre-operative BCVA (mean 0.01±0.06).

Mean follow-up time was 28 (range, 12 and 76) months.

Visual Recovery

No statistically significant difference in pre-operative BCVA was noted between the two groups. BCVA improved in both groups postoperatively, and there was no statistically significant difference between the two groups (Table 2).

IOP

During follow-up, glaucoma developed in 5 (41.6%) eyes with PC ICL. No eye with AC ICL developed glaucoma overtime. The prevalence of glaucoma was significantly higher in eyes with PC ICL (p=0.02, t-test).

Complications

Late graft rejection was observed in 1 (14.3%) eye with AC ICL and 3 (25%) eyes with PC ICL (p=0.07, t-test). Rhegmatogenous retinal detachment or macular edema did not take place in any of the patients. Choroidal detachment due to post-operative hypotony that occurred in an AC ICL implanted eye was successfully treated with systemic corticosteroid (methylprednisolone, 32 mg daily for 7 days and then tapered off) and resolved in a week. All other complications are listed in Table 3.

Table 1. CT indications and lens conditions of all eyes

Eye number	CT indication	Lens condition
1	BK	AC IOL
2	KK	Phakic
3	BK	Aphakic
4	KK	Phakic
5	Corneal opacity (HK)	Phakic
6	Corneal opacity (HK)	Aphakic
7	BK	PC IOL
8	BK	AC IOL
9	BK	AC IOL
10	BK	AC IOL
11	BK	Aphakic
12	Corneal opacity (PI)	Phakic
13	Corneal opacity (PI)	Phakic
14	BK	AC IOL
15	BK	Aphakic
16	BK	Phakic
17	BK	Aphakic
18	BK	AC IOL
19	BK	AC IOL
20	BK	AC IOL

AC IOL: Anterior chamber intraocular lens; BK: Bullous keratopathy; CT: Corneal transplantation; HK: Herpetic keratitis; KK: Keratoconus; PC IOL: Posterior chamber intraocular lens; PI: Penetrating injury.

Table 2. Comparison of mean BCVA between two groups preoperatively and postoperatively

Group	Pre-operative (range)	Post-operative 6^{th} month (range)
PC ICL	0.064 (0.001–0.02)	0.17 (0.001–1)
AC ICL	0.02 (0.001–0.1)	0.14 (0.001–0.4)
P-value	0.86	0.81

PC ICL: Posterior chamber iris claw lens; AC ICL: Anterior chamber iris claw lens.

Table 3. Post-operative complications

Complication	PC ICL (%) (n=12)	AC ICL (%) (n=8)
IOL dislocation	2 (16.6)	0
Glaucoma	5 (41.6)	0
Choroidal detachment	0	1 (12.5)
Hypotony	1 (8.3)	1 (12.5)
Graft rejection	3 (25)	1 (14.3)

AC ICL: Anterior chamber iris-claw lens; IOL: Intraocular lens; PC ICL: Posterior chamber iris-claw lens.

Discussion

P-CT is a challenging surgical procedure when combined with crystalline lens extraction, or IOL explantation and secondary IOL implantation. The best option for IOL implantation at the time of P-CT in the absence of capsular support is still not clear. Scleral fixation of IOLs can be performed but the procedure has its own technical difficulties and involves manipulations in the vitreous base with the risk of retinal tears and/or detachment.[8,9] Many anterior segment surgeons are not comfortable with this complicated and bothersome procedure.

The ICL was initially developed for attachment to the anterior iris. However, besides advantages of easy insertion and enclavation, AC implantation puts the corneal endothelium at risk.[10] This is particularly important in eyes with corneal transplant because the graft endothelium is already compromised and there is a risk of rejection.[11] In PC placement of ICL, the iris acts as a protective barrier for endothelium, but it requires more maneuvers and takes more time.[12,13] Moreover, PC insertion of ICL might be complicated with posterior dislocation of the IOL.[14,15]

Rijneveld et al.[16] published the first study of ICL in combination with P-CT. BCVA improved in 83% of their patients, and all eyes with BCVA ≥20/40 had an AC implantation. Complications such as glaucoma and lens dislocation were rare. Pigment dispersion – without clinical significance – was seen in 16.7% of the eyes and all of them were in the PC implantation group. Herein, BCVA improved after surgery in both groups, and there was no statistically significant difference between two groups.

Rüfer et al.[17] reported higher secondary glaucoma incidence (33%) in patients with PC ICL combined with P-CT compared to patients with PC ICL implantation alone. They concluded that P-CT could be the main risk factor for glaucoma in those patients. In the present study, secondary glaucoma incidence was significantly higher in PC ICL group (41.6%). The reason can be the pigment dispersion observed in PC ICLs in the long term. In contrast to the present study findings, Dighiero et al.[18] reported no glaucoma in a group of 5 PC ICL implanted patients. Furthermore, Gonnermann et al. did not observe any increase in IOP or worsening of glaucoma, in their study of 23 eyes with PC ICL and P-CT combination.[16]

Herein, incidence of lens dislocation was higher in PC ICL group (16.6%) when compared with AC ICL group (no eyes). Rüfer et al. observed PC ICL dislocation in 2 patients (20%) and Gonnermann et al.[11] observed the same complication in 3 (13%) eyes.[17,19] Dighiero et al.[18] and Hsing and Lee[20] did not observe ICL dislocation in any eyes with PC ICL.

Rüfer et al.[17] reported choroidal detachment in one patient with PC ICL, while Hsing et al.,[20] Rijneveld et al.,[16] and Dighiero et al.[18] reported no choroidal detachment in their studies. We observed choroidal detachment due to hypotony, which resolved in a week with treatment in one patient with AC ICL. We also observed transient hypotony in a patient with PC ICL, which did not lead to choroidal detachment. Vitreous hemorrhage did not occur in any of the patients.

The main limitation of the study is the absence of endothelial cell count after ICL implantation. However, specular microscopy is not an easy to use tool in P-CT patients. As many of them have irregular ocular surfaces, the measurement is usually not possible or not reliable.

Both AC and PC ICL implantation provide favorable visual results and complication rates in CT patients. PC ICL implantation – as shown in many previous studies – has many advantages for corneal endothelial protection, which is especially important in P-CT cases.[21–23] However, even if this technique looks safe for corneal endothelium, these patients should be carefully monitorized for IOP elevation due to increased glaucoma incidence.

Ethics Committee Approval: The study was approved by the local ethics committe at Ege University Faculty of Medicine.

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