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Pars plana vitrectomy and artisan iris fixated intraocular lens for aphakia in complicated vitreoretinal referrals

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ABSTRACT

Objective: To evaluate postoperative outcome of cases undergoing Artisan aphakic iris fixated intraocular lens implantation (IOL) in complicated vitreoretinal referrals, at Outpatient Department of Ophthalmology, Rudolf Foundation Clinic, Vienna, Austria. **Methods:** It was a retrospective interventional case series involving 24 patients who have undergone pars plana vitrectomy (PPV) with the Artisan iris fixated lens implantation procedure. Herein, procedures, preoperative corrected distance visual acuity (CDVA), causes of referral, post-operative CDVA and clinical complications were recorded. **Results:** The mean age of 24 patients (17 males and 7 females) was (69.88±14.50), with the range 32–83 years. The mean preoperative visual acuity was (1.40±0.83) with the range 0.46–3.00 log MAR units. After a mean follow up period for (3.12±2.54) with the range 1–12 months, the mean CDVA at the last follow-up was (0.95±0.84) log MAR units with the range 0.097–3.000 log MAR units. Complicated cataract surgery was the most common cause for referral with the value, 54.21% among cases, n=13. Secondary glaucoma was the commonest postoperative complication 25.00% with n=6. The other complications included were transient hypotony (n=3; 12.51%), hyphaema (n=2; 8.34%), corneal oedema (n=1; 4.17%), corneal erosion (n=1; 4.17%), vitreous haemorrhage (n=2; 8.34%) and oval pupil (n=1; 4.17%). Paired *t* test result showed no significant difference between preoperative and postoperative visual acuities (*P*>0.05). **Conclusions:** Artisan iris fixated IOL's are a safe and effective option in eyes with concomitant poor capsular support and vitreoretinal complications requiring PPV. The postoperative visual acuity depends on the underlying pathological features present preoperatively.

1. Introduction

Posterior capsule rupture of natural human crystalline lens with associated complications is a nightmare for any ophthalmic surgeon. In the event of subluxation or dislocation of intraocular lens (IOL) or crystalline lens into the vitreous, the surgical correction of aphakia can be achieved by several methods of IOL implantation, such as, open loop anterior chamber IOLS (ACIOL's), transclerally sutured PCIOL's, iris sutured PCIOL's or iris fixated AC IOL's^[1], PCIOL's and glued IOL's. On the

other hand, to deal with the associated comorbidities many times, a pars plana vitrectomy is a logistic requirement prior to the implantation of an artificial lens. Further, angle supported IOL's have fallen out of favour, due to post operative complications, corneal edema, intraocular inflammation, glaucoma and lower visual acuity^[2,3].

The scleral fixated IOLs are technically challenging, time consuming and associated with a high risk of ocular hypertension, retinal detachment and suture related complications^[4,5]. Glued IOLs are another viable option without any need for IOLs with eyelets or special haptic designs, by the by, with no IOL tilt, haptic movement and pseudophacodonesis.

Observations were made for 6 weeks postoperatively, but emphasis for long term functional and anatomical results and a longer follow up period with more number

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of patients was required[6]. Since, biological fibrin glue was used in this procedure there is always a theoretical risk of transmission of viral infections. Recently, iris fixated lens, the Artisan lens, fixed to the mid peripheral portion of the iris are popular, as it does not interfere with the angle structures or the normal physiology of the iris[7], and it is devoid of suture related complications, besides being a faster and effective alternative option compared to the more technically challenging glued IOLs[8].

There are several studies, reporting varying results with Artisan lens in aphakia, some associated with pars plana or anterior vitrectomy[1,2,6–9], wherein, lens implantation has been done either as a primary or a secondary procedure. A priori, no report deals solely with iris fixated lens implantation in complicated vitreoretinal referrals, where PPV has been done. Two similar studies have dealt with only lens implantation in complicated cataract cases[7,8]. Yet another has dealt with secondary implantation of Artisan lens in post traumatic vitrectomized eyes[5].

We will be presenting the preoperative and the post-operative results of patients, who presented to us as referrals from other centers and had parsplana procedures done along with placement of an Artisan IOL to correct aphakia.

2. Materials and methods

The study was conducted retrospectively in the Ophthalmology Department of Rudolf Foundation clinic. Operation theatre registers was reviewed for identifying patients who had artisan lens implantation in the past 7 years from January 2005 to February 2012.

2.1. Inclusion criteria

All cases that were referred from other hospitals and had undergone pars plana procedures with iris fixated IOL implantation for: 1. Posterior dislocation of nucleus or IOL following cataract surgery; 2. Patients who had traumatic posterior dislocation of lens; 3. Patients with retina detachment and vitreous haemorrhage; 4. Aphakic or Pseudophakic cases that have undergone previous retinal surgery or require vitreoretinal surgical procedure, along with lens placement or exchange.

2.2. Exclusion criteria

Exclusion criteria were: 1. Patients with central corneal pathology; 2. Multiple iris defects, fixed dilated pupils, recurrent uveitis, proliferative diabetic retinopathy.

2.3. Methodology and surgical procedure

Fifty two patients were found to have these iris fixated lens placement for varying reasons. Case records of all the patients were reviewed for further identifying patients, who were referred from outside and required parsplana procedures along with correction of aphakia. A total of 24 patients met our inclusion criteria.

Surgeries were done by four surgeons well versed in vitreoretinal procedures and cataract surgery. There was anterior fixation of lens in 22 cases and posterior fixation of lens in 2 cases. The following data were collected –age, gender, preoperative visual acuity, intraocular pressure, presenting ocular diagnosis, interval between previous surgery and surgery at the institute, associated surgical procedure done, postoperative complications, postoperative best corrected visual acuity at the last follow up and the duration of follow up.

A standard three port 23G pars plana vitrectomy opening was made in all cases. The vitreous surrounding the dislocated lens, lens fragments or IOL as the case required was carefully removed. Lens fragments were removed using a phacofragmentome. Dislocated IOL'S were floated up to the pupillary level using perflourocarbon liquids and removed through the corneal incision using a lens holding forceps. In subjects requiring silicone oil removal the superior port was used for aspiration and inferior port for infusion. All procedures and retinal examination were facilitated by an endoilluminator. Following completion of different procedures air or perflouroethane infusion was done depending upon the surgeon's preference and case requirement.

On completion of the vitreoretinal procedures, corneoscleral incision was made from 11 o'clock to 1 o'clock along with two paracentesis at 9 o'clock and 3 o'clock positions. Intracameral acetylcholine (Miovision pharmacia) was injected to constrict the pupil and with adequate amount of viscoelastic tamponade an artisan IOL of appropriate power was gently slid into the anterior chamber. With a bluntinsky hook the IOL was dialled into a horizontal position parallel to the paracentesis sites to facilitate enclavation. A 23G Grieshaber internal limiting membrane forceps was inserted through the paracentesis and with the IOL held with a lens holding forceps through the main wound, the iris was carefully pinched and tucked into the haptic footplates. The procedure was repeated on the other side for the other haptic.

Three surgeons followed the procedure as described above whereas the fourth surgeon differed only in the insertion of the IOL. With the alternative procedure, a cyclodialysis spatula was inserted through the paracentesis and with the lens held with a lens holding

forceps through the main wound, the spatula was used for applying pressure from below to hook the iris gently between the footplates of the haptic. A superior peripheral iridectomy was made in all cases and wound secured with two to three 10.0 nylon interrupted sutures.

For the two cases where posterior fixation of iris claw lens was done, all the steps till insertion of lens were similar to that of anterior insertion of lens. Next the IOL was introduced halfway below the iris using a lens holding forceps and made to assume a horizontal position with centration just below the pupil. Simultaneously a spatula or a 24G hydrodissection cannula was used through the paracentesis of one side to enclavate the iris by gentle pressure from above on the region of the iris overlapping the discontinuity in the lens haptic while the lens was still held firmly in horizontal position with the lens holding forceps. The entire lens was slid below the iris with the optic still held by forceps and the other haptic similarly enclavated.

Decimal visual acuity was converted to logarithm of minimum angle of resolution (log mar) units for statistical analysis. Following the notation adopted by Gundula and associates^[11] counting fingers was converted to 2.0, hand movements was converted to 2.3, and light perception was converted to 3.0 (3.1=no light perception).

2.4. Statistical analysis

Microsoft excel data sheet (Microsoft Corp limited) was used for entering data. Range and mean with the standard deviation were calculated. Paired t test was used to calculate the difference between the means of the preoperative CDVA and postoperative CDVA.

3. Results

Twenty four referred patients (17 males and 7 females) had implantation of artisan IOL along with pars plana vitrectomy; the lens and posterior segment status of the patients along with the visual acuities at presentation and at the last follow up in the postoperative period were recorded. The mean follow up period was (3.13 ±2.54) days (Table 1). The main post-operative complication was secondary glaucoma (6, 25.00%) followed by hypotony (3, 12.51%) (Table 2). Complicated cataract surgery was the primary reason for referral ($n=13$; 54.2%). Among these, 5 patients had subluxated IOL, 7 patients had dislocated IOL, one nucleus drop and the last left aphakic, following a posterior capsular rupture. Majority of patients presented within a week of surgery, undertaken elsewhere, except a case with vitreous hemorrhage and cataract.

Those presenting beyond 6-month period of previous surgery (6 eyes; 25.9%) were for either silicone oil removal (8 eyes), post-traumatic retinal detachment surgery with cataract and zonular dialysis (1 eye) and post-trabeculectomy subluxated IOL (1 eye) apart from PPV and lens implantation, 6 patients required membrane peeling along with silicone oil removal. One of these patients was diabetic and had age related macular changes (case no.19).

Table 1

Summary of patient data.

Indexes	Range	Mean±SD
Age (yrs)	32–83	69.88±14.50
Preoperative visual acuity (logMAR)	0.046–3.000	1.40±0.83
Visual acuity at final follow-up (logMAR)	0.097–3.000	0.95±0.84
Duration of follow-up (mos)	1–12	3.13±2.54

Table 2

Post-operative complications.

Complications	<i>n</i>	Percentage
Hypotony	3	12.51%
Hyphaema	2	8.34%
Corneal edema	1	4.17%
Secondary glaucoma	6	25.00%
Corneal erosion	1	4.17%
Vitreous hemorrhage	2	8.33%
Oval pupil	1	4.17%
NIL	9	37.50%

Fifteen patients had a post operative visual acuity better than the preoperative visual acuity. In 7 patients, visual acuity worsened following surgery. One among these patients had a dislocated IOL with macular puckering and history of previous PPV and membrane peeling (case no.5). Eyes of 3 patients had prior epiretinal membrane in the presence of silicone oil and aphakia (case nos. 15, 17 and 20). Two of the 3 remaining patients (out of cited 7) had history of prior retinal detachment surgery with circlage (case nos. 10 and 22). One among these patients, who presented with a dislocated IOL, had a circlage procedure done, 16 years ago. He developed hyphaema post-operatively and had to have his IOL explanted in 2 days following surgery.

There was an appreciable improvement in the mean post-operative CDVA at the last follow up (0.95±0.84) compared to the preoperative CDVA (1.40±0.83), but this was not significant ($P>0.05$). The most common complication postoperatively was the raised intraocular pressure (21–25 mm Hg) in 6 eyes (25%) that was controlled medically. The raised pressure came down to normal values within 2 weeks, in all cases excepting the case no.12, who required topical glaucoma medications for the control of pressure (timolol eye drop; Alcon pharmaceuticals). Pre-operatively raised intraocular pressure was found in 4 eyes (case nos. 3, 18, 12 and 22).

One among these had secondary glaucoma following multiple retinal surgeries (case no.18). The second had a dislocated IOL (case no.3) and the third had a subluxated IOL, a previously diagnosed case of open angle glaucoma (case no.12). The fourth had glaucoma following retinal surgery for contusio–bulbi (case no.22). From amongst these cases, only the case with prior POAG (case no.18) had raised intraocular pressure post–operatively.

4. Discussion

The artisan lens was first introduced in the 1980's by Worst *et al*[2]. It is a polymethylmetacrylate lens with a central 5.4 mm optic and two flexible iris claws for fixation. Since it was fixed to the midperipheral iris it did not affect mydriasis, iris vasculature or damage the delicate structures of the angle.

Iris fixated lens are used for aphakia correction in different scenarios like, for complicated cataract surgery with posterior capsular rupture[9], and retained nuclear lens fragments[7]. Secondly in post traumatic vitrectomised eyes[5], with penetrating keratoplasties for aphakic bullous keratopathy[12], following lensectomy for ectopia lentis in children[13], bilateral cataract in children[14], and in association with complicated vitreo–retinal procedures like, retinal detachment repair surgery or vitrectomy for proliferative diabetic retinopathy surgery[1].

The iris lens can be fixated either anteriorly or posteriorly. The anteriorly fixed iris claw IOLs capture the midperipheral iris and are independent of the anterior segment size[9]. The anterior one may lead to endothelial cell changes, but the interval for this to occur is quite long, possibly a few years[14]. But again with the present design of vaulted iris claw lens designs, there is enough space between the lens and endothelium, to avoid harming the endothelium. Pigment erosion to develop secondary to posterior fixation in few eyes was expected[9]. But attribution to pigment precipitates on their cases to multiple factors like inflammatory reactions, intraocular lens design, surgical manipulation, iris hypotony and medications (pilocarpine, acetylcholine) were reported[5]. Further, another study has documented three cases of pigment dispersion in eighteen retropupillary implantations, whereas no case was observed in the anterior fixated ones[15]; on the other hand, with longer follow ups pigmentary glaucoma is another concern[15]. But posterior enclavation has an advantage over anterior in the event of disenclavation of one haptic, contact with the endothelium is not possible[17]. So we feel whatever may be the placement, an adequate amount of viscoelastic

should be used to provide intraoperative tamponade.

The present generation of refractive iris fixated IOLs leave enough space between themselves and the endothelium to avoid harming the endothelium in both phakic and aphakic eyes[9]. With posterior fixation there is preservation of the anatomic features of the anterior segment as it assumes a more anatomically appropriate position[9]. But this carries more value in eyes where only cataract surgery is done. Our group of patients has additional procedures like, silicone oil removal, gas or air tamponading, sclera buckling and posterior vitrectomies where post operative refraction was bound to be grossly altered. The intrascleral posterior chamber glued IOLs have a similar appropriate position, but required more expertise, manipulations and are time consuming. We have had twenty two patients with anterior fixation and two with posterior fixation, done according to the surgeon's preference. Posterior fixation was tried in two cases, decided by the surgeon preoperatively, as it preserves the anatomic features of the anterior segment with respect to the iridocorneal angle along with providing a diaphragm–like effect for the posterior segment. This helps in providing endotamponade and is thereby useful in vitreoretinal cases. Apart from that, endothelial touch is also avoided. But, at the same time it is slightly more challenging procedure, compared to the anterior fixated one, and there is always a chance of posterior dislocation of the lens in case of failure of enclavation. In spite of a lesser mean pre–operative visual acuity in our patients compared to a study, where PPV was done with scleral fixated sutured posterior chamber intraocular lens for sixty three patients[11], the mean post–operative visual acuity was considerably better in our study (0.95 ± 0.84).

The initial best corrected visual acuity was compromised in our patients due to the underlying pathologic features like, epiretinal membranes (case nos. 15, 16 and 17), age–related macular degeneration (case no.19), primary open angle glaucoma (two eyes), previous retinal surgeries (nine eyes) and corneal edema (case no.1). In a study of seventeen post–traumatic vitrectomised eyes, where there was secondary implantation of artisan IOL on 88.8% eyes had the same or a better post–operative CDVA, compared to the preoperative CDVA[5]. In this study group, 70.89% attained the same or better CDVA, postoperatively. But their inclusion criteria included vitrectomised traumatic eyes only, with the exclusion of even diabetic patients developing epiretinal membrane during follow up. In contrast our patients had a variety of pathologic features outlined previously.

A retrospective study of artisan lens implantation after vitrectomy for retained lens fragments in 13 patients was reported[7]; 2% of their patients gained 20/40 or better vision in spite of several of these patients having

corneal decompensation (ten eyes) and glaucoma (eight eyes). Majority of our cases (33.3%) were referred from outside within a week of previous surgery. There was only one case that had not undergone any surgery and was referred to for blunt trauma to the right eye along with phacodonesis, vitreous haemorrhage and retinal tear (case no.24). The follow up period was limited in our study (3.13 ± 2.54), due to patients being sent back to the referring general ophthalmologist for follow up. As a result, many long term complications may have been overlooked. This contrasts with similar studies with mean follow up ranging from 14.65 to 28.9 months^[5,6].

Iris fixated IOL'S have been associated with a wide range of complications like, recurrent erosion, retinal tear during photocoagulation, post operative inflammation (comparable to patients with posterior chamber IOL's), secondary glaucoma, hyphaema, vitreous haemorrhage, hypotony, pigmented precipitates, retinal premacular fibrosis, Cystoid macular edema, and retinal detachment^[5]. Preexisting pathologies, elderly patients (69.88 ± 14.50), previous vitreo retinal complications are contributing factors for the complications we have encountered in our cases. All cases of secondary glaucoma, the most common complication encountered by us were controlled medically. With secondary implantation of iris fixated lens in seventeen eyes, only two cases of secondary glaucoma have been reported^[5].

One of our patients with hypotony postoperatively had undergone multiple retinal detachment surgeries previously (case no.18). We had three cases of hypotony and all the cases recovered spontaneously (case nos. 2, 17 and 18). With a secondary implantation of iris fixated lens after PPV, 5.5% incidences of hypotony due to scleral tunnel insufficiency was reported^[5]. In a study investigating the complication profile of combined PPV and scleral fixated posterior chamber IOL, 39.6% cases required a second surgery to reverse complications^[11]. They have attributed it to a high incidence of trauma in their case series (40%). Only one patient (4.17%) in our case series required a second surgery that was anterior chamber wash for hyphaema, but ultimately the IOL had to be explanted (case no.22). Corneal edema present in one of our cases cleared up in a month's time (case no.11). Of course, there has been report of recurrent corneal erosion^[6]. Our corneal erosion (case no.13) was suture related and took one month time to heal with lubricating drops. We have had a single case of pupil ovalization (case no.4). Though it was not a common complication, it had been reported in seven patients (37%), elsewhere^[17,18]. Considering the severity of the initial disease it is said to be an acceptable complication^[12]. But these cases were in association with penetrating keratoplasty^[13,15] and toric phakic IOL implantation^[16], but not PPV. With the scleral fixated

posterior chamber IOL fixation done along with PPV there had been a case of pupillary capture only^[7].

We had 2 cases of vitreous haemorrhage (8.35%) post-operatively. But both cases had previous multiple surgeries for retinal detachment and required silicone oil removal during PPV. Despite this the haemorrhage in both the cases cleared up within two months and did not require any surgical intervention. Muellen and Riazi *et al*^[5,7] did not have any case of vitreous haemorrhage whereas Gundula *et al*^[11] have reported vitreous haemorrhage in three (4.8%) of their cases that further required PPV after scleral fixated IOL implantation. Besides corneal erosion there were no suture related complications in our series in contrast to Gundulas *et al*'s study, where they have had two cases of suture breakage and one IOL dislocation due to haptic slipping out of the knot used for fixing.

Like any retrospective study there are several potential limitations of our study. A follow up for a short period is one of the major deficiencies. As a result various long term complications like, cystoid macular edema, retinal detachment, late proliferative vitreo retinopathies, macular puckering, IOL decentration may have been missed. Pre-operative endothelial cell densitometry and morphologic evaluation had not been done in all cases, limiting the possibility of studying the changes on the corneal endothelium. Despite these shortcomings, we can suggest that iris fixated Artisan lens implantation is a viable option in the setting of referred cases, requiring vitreoretinal procedures due to the simplicity of the procedure, fewer manipulations and facilitation of good visualization of the peripheral retina post-operatively.

In summary, though patients included in our study had a greater risk of post-operative complications, results suggest that PPV in combination with Artisan iris fixated lens is a safe and was an effective option for aphakia correction in eyes with deficient posterior capsular support. Further, prospective studies with larger numbers of patients and longer follow ups comparing iris fixated lens and scleral fixated lens implantation, with PPV procedure, done in patients with various vitreoretinal complications are needed to document the statistical significance of the different post-operative outcomes in each group.

Conflict of interests statement

The authors declare that we have no conflict of interests.

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