

Iris-claw intraocular lens implantation: Anterior chamber versus retropupillary implantation

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Purpose: To compare the outcomes of anterior chamber and retropupillary implantation of iris-claw Artisan intraocular lenses (IOL). **Design:** Prospective, randomized, single-blinded study. **Patients and Methods:** Forty eyes of forty aphakic patients were enrolled. Patients were randomized into two groups. Each group includes twenty patients. Group 1 received anterior chamber Artisan IOL implantation. Group 2 received retropupillary Artisan IOL implantation. Preoperative and postoperative corrected distance visual acuity (CDVA), intraocular pressure (IOP), and all complications were noted and compared at 6 months follow-up. **Results:** Each two groups obtained a significant improvement in CDVA ($P < 0.05$). Four patients in Group 1 and five patients in Group 2 had significant but nonpermanent increase at IOP values. There were one and two pupillary irregularity in Group 1 and Group 2, respectively. In one patient, a shallow and inferior located retinal detachment were encountered in anterior chamber group. **Conclusions:** The results were not significantly different between the two fixation techniques for iris-claw lens. The surgery procedure is dependent to surgeon experience and eye's conditions.

Key words: Aphakia, Artisan lens, retropupillary implantation

There are many procedures to correct the aphakia in patients who have usually trauma history or a complicated surgery. The surgical procedure that is utilized is dependent to some factors such as capsular support or condition of iris. With the condition of the presence of adequate capsular support, ciliary sulcus implantation of the intraocular lens (IOL) is the best choice. However, in cases of aphakia secondary to trauma or complicated surgery, capsular support is usually absent. In these cases, there are several ways to correct the aphakia such as sutured scleral fixation, intrascleral fixation, angle-supported anterior chamber, and anterior chamber or retropupillary iris-claw IOLs.^[1-4] Eye's status as well as surgeon's experience determines the procedure of choice. Previous studies reported that angle-supported anterior chamber IOLs may cause secondary glaucoma, iridocyclitis, and corneal endothelial decompensation.^[5] Although trans-scleral fixated IOL causes less cornea endothelial damage and less uveitis, it is technically more challenging with high incidence of complications.^[6]

Previous studies have established that iris-claw Artisan IOL implantation is an effective method for the correction of the aphakia with several advantages such as having fewer complications, with its easy placement and good visual outcome, when compared with the transscleral sutured IOLs and angle-supported anterior chamber IOLs.^[7] Phakic model of Artisan IOLs has utilization for the correction of high myopia in anterior chamber, which has passed Food and Drug Administration approval certification as well.^[8]

Until now, it has been shown that Artisan IOLs have had positively clinical outcomes versus sutured scleral fixation

and angle-supported anterior chamber IOLs.^[9,10] Concerning the location of implantation of Artisan IOL, the data have conflicting results. Artisan IOLs could be applied to anterior chamber over the iris or retropupillary.^[1,9-11] However, comparison of anterior chamber iris fixation and retropupillary implantation of iris-claw Artisan IOLs has not been studied yet. Therefore, the purpose of this study was to compare efficacy and complications of anterior and retropupillary implantation of Artisan IOL.

Patients and Methods

This study was designed as randomized and single-blinded. Forty patients with aphakia were randomized and allocated into anterior chamber (Group 1) and retropupillary implantation (Group 2) group. Each group included twenty patients' twenty eyes. Group one received Artisan iris-claw IOL (Ophtec, Groningen, The Netherlands) implantation over the iris, and Group 2 received retropupillary Artisan IOL implantation. Preoperative and postoperative features were compared.

This study protocol was approved by the Local Ethics Committee and written informed consent form was obtained from all patients.

Patients who were admitted to Adana Numune Training and Research Hospital with aphakia and no capsular support

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between November 2013 and April 2014 were included in this study. Inclusion criteria included aphakia which is due to trauma, complicated cataract surgery and lens/IOL luxation, integrity of the iris which allows to enclavation of the IOL's claw, normal intraocular pressure (IOP) limits, anterior chamber depth > 3.2 mm, endothelial cell density > 900/mm², and normal retinal examination. Exclusion criteria were glaucoma, iris defect, uveitis, and any pathology of the retina.

Clinical and demographic features (such as age, gender, and etiology of aphakia) of the patients were noted. IOP which measured with Goldmann applanation tonometry, Snellen's corrected distance visual acuity (CDVA), slit-lamp biomicroscopy examination, and fundus examination were evaluated preoperatively and at 24 h, 1st week, 1st, 3rd, and 6th month postoperatively by the same examiner. Anterior chamber depths measured by Pentacam anterior segment analyzer. All the complications were noted.

All the data were analyzed using SPSS 18.0 package (Ophtec, Groningen, The Netherlands) program. Data were expressed as a mean \pm standard deviation. Afterward checking if the data have a normal distribution, paired samples *t*-test was used to compare the preoperatively and postoperatively CDVA and IOP values. Comparison of indications and complications were analyzed with Chi-square test. Statistical significance was set at $P < 0.05$.

IOL power was calculated with an A-constant of 115 for Group 1, and 117 for Group 2 by ultrasonic biometry (Digital A/B scan 5500; Sonomed Inc., Lake Success, NY, USA). All operations were done by the same surgeon under the subtenon anesthesia. Since some patients have IOL luxation, lens luxation or luxated nigra cataract, operation was combined with pars plana vitrectomy and IOL/lens explantation.

The surgeon performed iris-claw IOL implantation with the same standardized technique. In summary, two vertical side-port at 2 and 10 o'clock were performed. Intracameral carbachol (0.10 mg/ml) and subsequently cohesive viscoelastic was injected. Thereafter, anterior vitrectomy and preparation of 5.5 mm limbal corneal incision were performed. Artisan IOL with a position of convex side up for Group 1, convex side down for Group 2 was inserted, rotated the IOL such that haptics were positioned at 3 and 9 o'clock and centralized. Thereafter, Artisan IOL's optic was holded with its special forceps; for anterior chamber group iris was enclavated between the IOL's claw haptics using special enclavation needles. After repositioning the IOL behind the iris and centralized, iris was enclavated using the above-mentioned special needles. Superior peripheral iridectomy was performed for only Group 1. Corneal incision was closed with interrupted sutures. Viscoelastic material was aspirated, and subconjunctival gentamicin and dexamethasone were injected. Sutures were removed approximately 2 months postoperatively. All the patients were prescribed prednisolone acetate and moxifloxacin drop 5 times/day.

Results

A total of forty eyes (Group 1: Twenty anterior chamber iris-claw fixation, Group 2: Twenty retropupillary iris-claw implantation) of forty different patients (24 males, 16 females) with aphakia of various etiologic reasons were treated with Artisan IOL. Mean age of the patients was 69.2 ± 7.4 (min-max: 45–82 years). The demographic features were summarized in

Table 1. Eleven (55%) patients' right eyes, 9 (45%) patients' left eyes, 12 (60%) patients' right eyes, and 8 (40%) patients' left eyes were treated in Group 1 and 2, respectively. When evaluating the age range, in each group, there was an accumulation among 70–79 age. The various etiological reasons were summarized in Graphs 1 and 2 for both groups. When comparing the each group the most causative etiologic factor was complicated cataract surgery resulted in aphakia (65% and 65% for Group 1 and 2, respectively). There was no statistically significance when indications compared between the two groups ($P = 0.434$).

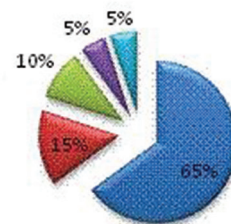
There was no complication intraoperatively and desired anatomic conclusions were achieved [Fig. 1]. No hypotony, uveitis, cystoid macular edema, IOL dislocation, hyphema, and vitreous hemorrhage were seen at long-term follow-up (1st week - 6th month) like mentioned about in the other studies.^[6] All the IOLs were well-centered. Pupil dilatation was acceptable which let the fundus examination. Nevertheless, pupillary distortion was seen in one patient in Group 1 and in two patients in Group 2. However, these distortions were ended up in a week. There was an individual whom was seen retinal detachment in Group 1. Since aforementioned detachment was in the inferior retina with a shallow feature, it was just followed with no intervention in a 6 months follow-up. Elevated IOP

Table 1: The demographic features of the patients

	Operation procedure	
	Anterior chamber	Retropupillary
Sex (%)		
Female	9 (45)	7 (35)
Male	11 (55)	13 (65)
Age	68.5 \pm 6.8 70 (16-90)	69.9 \pm 8.2 70.5 (55-91)
Age range (%)		
<65	6 (30)	6 (30)
65-69	2 (10)	4 (20)
70-79	9 (45)	7 (35)
>79	3 (15)	3 (15)

Indications of anterior chamber group

- Complicated cataract surgery resulted in aphakia (13)
- Peroperative IOL luxation (3)
- Peroperative lensluxation (2)
- Previous intracapsular cataract extraction (1)
- Spontaneous lens subluxation (1)



Graph 1: Surgery indications of Group 1

were noted in four patients in Group 1 and in five patients in Group 2 1st week postoperatively. These increases were statistically significant for each group at 1st week ($P < 0.05$). All patients' increased IOP values were controlled adequately with a fix combination of hypotensive drop (dorzolamide/timolol 2 times/day). When the treatment stopped just a few weeks later, there was no permanent increase of IOP. There was no statistically significance when complications range compared between the two groups ($P = 0.067$).

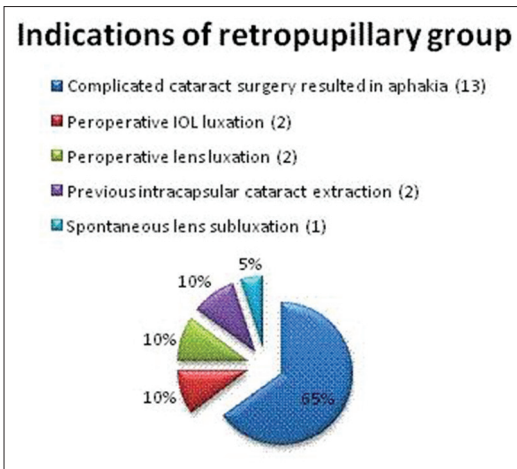
When evaluating the CDVAs in both groups, there was statistically significant increase when compared the preoperatively and for each 1st week, 1st, 3rd, and 6th month values ($P < 0.05$). However, these increases were stabilized since 1st month visit. Sixteen patients achieved the same final CDVA values, four patients achieved poorer CDVA values that were measured preoperatively in Group 1. Eighteen patients achieved the same final CDVA values, two patients achieved a poorer CDVA that was measured preoperatively in Group 2. The comparison of CDVAs and IOP values were summarized in Table 2. CDVAs and IOP values were summarized in Table 3. Mean spherical equivalent (SE) was $4.98 \pm 5.99D$ in Group 1 and 4.87 ± 6.01 in Group 2 preoperatively. When evaluated postoperatively, SE decreased to $-0.25 \pm 1.87/-0.25 \pm 1.75$ in Group 1 and 2, respectively.

Discussion

In this study, we aimed to compare the short-term efficiency and complications of anterior chamber and retropupillary implantation of Artisan IOL, to the best of our knowledge, it is the first time in data. There had been many reported studies that evaluated the angle-supported and scleral fixated IOLs in case of insufficient capsular support.^[12,13] In contrast to aforementioned surgery procedures; Artisan IOL seems to be safer, efficient, and easily applicable way to correct aphakia.

In our presented study, we corrected aphakia using Artisan IOL (model 205) over and behind the iris. Artisan IOL for aphakia is a single-piece polymethyl methacrylate IOL with its 5.4 mm optic body and 8.5 mm overall length. There is a large available diopter range (+2.0D to +30.0D with 1.0D increments and + 14.5D to + 24.5D with 0.5D increments).

All cataract surgeries may cause endothelial cell loss.^[14] However, endothelial decompensation does not occur in all cases. Güell *et al.* reported that Artisan IOL implantation caused approximately 10.9% endothelial cell loss in the 3 years follow-up.^[15] Anbari and Lake reported preoperative manual endothelial cell density mean of 2269 ± 611 cells/mm² decreased postoperatively to 2002 ± 532 cells/mm² at 2 years ($P = 0.0005$).^[16]



Graph 2: Surgery indications of Group 2

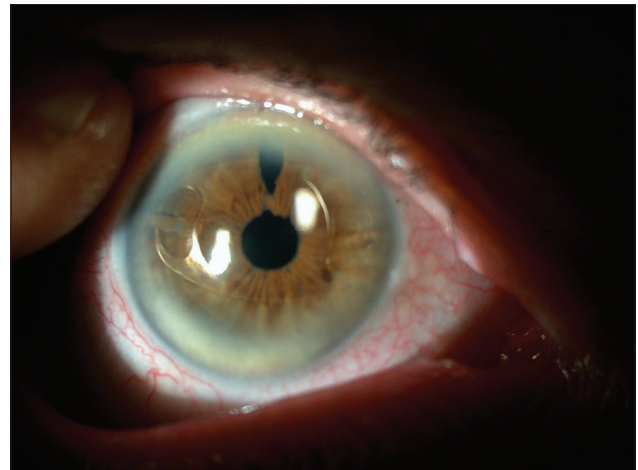


Figure 1: An implanted anterior chamber Artisan intraocular lens

Table 2: P values of the best corrected visual acuity and intraocular pressure values at 6 months follow-up

Measurements	CDVA (P)		IOP (P)	
	Group 1	Group 2	Group 1	Group 2
Preoperation versus 1 st week postoperatively	0.000	0.000	0.031	0.000
Preoperation versus 1 st month postoperatively	0.000	0.000	0.179	0.122
Preoperation versus 3 rd month postoperatively	0.000	0.000	0.314	0.125
Preoperation versus 6 th month postoperatively	0.000	0.000	0.344	0.154
1 st week postoperatively versus 1 st month postoperatively	0.000	0.001	0.04	0.001
1 st week postoperatively versus 3 rd month postoperatively	0.001	0.001	0.034	0.02
1 st week postoperatively versus 6 th month postoperatively	0.001	0.001	0.001	0.001
1 st month postoperatively versus 3 rd month postoperatively	0.330	0.379	0.780	0.695
1 st month postoperatively versus 6 th month postoperatively	0.344	0.387	0.698	0.578

CDVA: Corrected distance visual acuity, IOP: Intraocular pressure

Table 3: Best corrected visual acuity and intraocular pressure values of each group at 6 months follow-up

Measurements	Mean±SD Median (minimum-maximum)			
	CDVA (logMAR)		IOP	
	Group 1	Group 2	Group 1	Group 2
Preoperation	1.1±0.373	0.92±0.440	14.05±2.685	14.80±3.397
	1.10 (0-2)	1.00 (0-2)	14.00 (9-20)	15.00 (9-22)
1 st week postoperatively	0.7±0.344	0.6±0.275	16.45±4.571	20.10±5.119
	0.60 (0-1)	0.55 (0-1)	15.00 (11-30)	18.00 (14-30)
1 st month postoperatively	0.60±0.290	0.5±0.237	14.60±2.162	16.20±2.093
	0.50 (0-1)	0.50 (0-1)	14.00 (11-20)	16.00 (12-21)
3 rd month postoperatively	0.60±0.278	0.5±0.240	14.75±1.773	15.75±1.916
	0.50 (0-1)	0.40 (0-1)	15 (12-19)	15.00 (13-19)
6 th month postoperatively	0.60±0.258	0.5±0.230	14.85±1.573	15.65±1.826
	0.50 (0-1)	0.40 (0-1)	15 (11-18)	15 (12-18)

CDVA: Corrected distance visual acuity (in logMAR), IOP: Intraocular pressure, SD: Standard deviation, logMAR: Logarithm of the minimum angle of resolution

In our series, no clinical sign of endothelial decompensation was observed in both groups. Gicquel *et al.* reported that anterior chamber implantation results in more endothelial cell loss than the retropupillary implantation.^[17] Anyway, since the Artisan IOL's haptics probable contact is being prevented to the endothelium; it should be safer to implant it retropupillary.

Sekundo *et al.* reported some contraindications for iris-claw lens implantation such as ischemic vitreoretinopathies, such as diabetes or vascular occlusive entities, as well as uveitis.^[18]

Four patients in Group 1 and five patients in Group 2 had IOP increase. When compared the amounts of patients whose IOP values were increased in each group, there was no statistically significance ($P=0.543$). We consider that performing an efficient anterior vitrectomy prevents a permanent IOP increase. Moreover, we did not observe a pupillary block in both groups. Therefore, the necessity of performing peripheral iridectomy in either group is controversial. Pupil distortion was observed in three patients; however, none of them was permanent.

A considerable disadvantage of Artisan IOL is that it requires a wide corneal incision because of its 5.4 mm width polymethyl methacrylate optic body. Therefore, it may cause serious astigmatism. Another difficulty of retropupillary implantation is the probability of IOL dislocation to vitreous due to enclavation fail. No dislocation was seen in our series.

Although anterior implantation has a risk of endothelial touch in shallow anterior chambers, it is easier than retropupillary implantation. In both ways, the permanent IOP increase is not common. Accordingly, this article suggests that both anterior and retropupillary implantation of Artisan IOL are effective in visual improvement, comfortable applicable, and time-saving surgery technique. As regards the limitation of this study was its small sample size and not to count the endothelial cell density. Patients could be followed up longer as well.

In consideration of our first and preliminary results, both anterior and retropupillary implantation of Artisan IOL are easy applicable surgery procedures. The surgical procedure is dependent to the experience of the surgeon. To assess the

safety and efficacy of these two methods, long-term follow-up is needed. Further studies are required to compare the anterior and posterior implantation of Artisan IOL taking into account endothelial cells counting with more sample size and long-term follow-up.

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Conflicts of interest

There are no conflicts of interest.

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