***Original Article***

# Coreoplasty and Artisan Intraocular Lens Implantation for Mydriasis and Aphakic Correction in Post-traumatic Vitrectomized Eyes

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**Abstract**

**Purpose**: To evaluate the efficacy and safety of using coreoplasty, and an iris-supported Artisan intraocular lens (IOL), for mydriasis and aphakic correction in post-traumatic vitrectomized eyes.

**Methods**: A total of 17 aphakic patients were admitted between April 2009 and April 2010 to the ophthalmologic department of Xiamen Eye Centre. All eyes had previously received lens removal and vitrectomy. After the retina stabilized and corrected visual acuity improved, the iris was sutured. The Artisan IOL was fixated onto the iris surface. Patients were followed-up at one day, one week, one month and three months postoperatively. The following outcomes were assessed: symptoms of photophobia and glare, uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), intraocular pressure (IOP), endothelial cell density (ECD). The diameter of pupil and the anterior chamber depth (ACD) were measured by the anterior segment optical coherence tomography (OCT).

**Results**: Artisan IOLs were successfully implanted in all aphakic eyes. Postoperatively, improvement was observed in photophobia and glare symptoms. UCVA was enhanced in all patients (six eyes had better UCVA postoperatively than BCVA preoperatively). However, there were no significant changes in IOP. Mean loss of ECD was 336.06/mm$^2$. Mean postoperative pupil diameter was 3.67±0.41 mm, compared with 5.67±0.57 mm preoperatively ($P$<0.05). Mean ACD was reduced by 0.88 mm (3.38±0.33 mm preoperatively vs 2.50±0.35 mm postoperatively, $P$<0.05).

**Conclusion**: Surgery that combined coreoplasty and Artisan IOL implantation was a safe and effective treatment for correcting aphakia and mydriasis in post-traumatic vitrectomized eyes. (***Eye Science 2012; 27:119-123***)

**Keywords**: coreoplasty; iris-supported artisan intraocular lens; vitrectomized aphakic eyes

## Introduction

Combined injuries often occur after ocular trauma1. Blunt ocular trauma can cause iris contusion, lens dislocation, vitreous hemorrhage and retinal contusion. Corneal or scleral penetration, iris damage, cataract, vitreous hemorrhage and retinal detachment were present following penetrating ocular injuries. Lens removal and vitrectomy serve as primary treatments. The status of fundus stabilizes while the anterior segment is severely injured. The latter is frequently associated with aphakia, mydriasis or aniridia. Symptoms including decreased visual function, photophobia or disability glare can be observed.

In this study, we performed a new combined surgery of coreoplasty and artisan IOL implantation in posttraumatic vitrectomized eyes to correct the aphakia and mydriasis simultaneously.

## Patients and methods

This study was reviewed and approved by the ethics committee of Xiamen Eye Centre of Xiamen University and in accordance with the declaration of Helsinki. Written informed consent was obtained from each patient before surgery. Seventeen unilateral aphakia patients (12 male and 5 female) admitted to the ophthalmologic department of Xiamen Eye Centre between April 2009 and April 2010 were en-

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rolled in this clinical trial.

Preoperatively all patients had full eye examinations including the symptoms of photophopia and glare, slit-lamp examination, fundus examination, uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), keratometry, intraocular pressure (IOP) and endothelial cell densitometry(ECD). The diameter of pupil and anterior chamber depth (ACD) were measured by the segment anterior OCT (AS-OCT, Carl Zeiss). IOL power was assessed by the SRKII formula (IOL master Carl Zeiss).

**Surgical procedure**

All surgical procedures were performed by one single surgeon. After topical anesthesia, a standard 6.0 mm scleocorneal tunnel was prepared at 12 o'clock position (limbal incision was made in four eyes due to superior sclera scar). Two paracenteses were placed at 10 o'clock and 2 o'clock. The ante rior chamber was filled with 2.3% sodium hyaluronate (Healon, Alcon) to protect endothelia cells, and then 1% acetylcholined was injected to the anterior chamber. A superior iris suture was made with 10-0 prolene suture to constrict the pupil below 4.0 mm. The iris-fixated artisan IOL was inserted, rotated into the target position, and fixated to the iris with a bent needle and an enclaration forceps. A peripheral iridectomy was performed at 12 o'clock position. The tunnel was sutured with interrupted 10-0 nylon sutures. Postoperative combination drops of dexamethasone and tobramycin were used qid, tapered and discontinued after 4 weeks.

The participants were followed up at one day, one week, one month and three months postoperatively. The indexes including photophobia and glare, slit-lamp examination of the anterior and posterior chambers, UCVA, BCVA, IOP, ECD, diameter of pupil and ACD were measured. Postoperative complications were observed.

**Statistical analysis**

All data were analyzed by 18.0 SPSS software package. Paired student *t*-test was used to compare measurement data. $P<0.05$ was considered as statistical significance.

## Results

A total of 17 patients(17 eyes) underwent surgery. The mean age was 48.8±14.16 years (range: 12~73 years). Five patients had a history of penetrating trauma while the other 12 suffered from blunt trauma. Cataract extraction or pars plana lensectomy and

**Table 1** Patient characteristics and ophthalmic data preoperatively

| Patient No. | Sex | Age (year) | OD/OS | Type of injury | Surgical history | Time of previous surgery(month) | UCVA | BCVA | Spherical equivalent | ECD (cells/mm$^2$) | IOL power(D) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M | 67 | OS | elbow | PPL,PPV,C3F8 | 4 | 0.01 | 0.15 | 12.75 | 2238.9 | 19.5 |
| 2 | F | 46 | OD | safety helmet | PPL,PPV,EL | 1 | 0.02 | 1.0 | 10.0 | 2936.2 | 18.5 |
| 3 | M | 27 | OD | glass splinter | PPL,PPV,EL,DO,Silicone | 4 | 0.02 | 0.8 | 10.0 | 1986.8 | 19.0 |
| 4 | M | 39 | OS | iron stick | CE,ASV | 1 | 0.01 | 0.6 | 11.0 | 2458.4 | 18.0 |
| 5 | F | 73 | OS | wooden stick | CE,ASV | 1 | 0.01 | 0.4 | 9.0 | 2052.6 | 18.5 |
| 6 | M | 59 | OD | fire cracker | PPL,PPV,EL,C3F8 | 2 | 0.01 | 0.5 | 9.5 | 2182.6 | 11.0 |
| 7 | M | 38 | OD | arrow | PPL,PPV,FB removal,EL,C3F8 | 2.5 | 0.02 | 0.5 | 11.0 | 1731.6 | 16.0 |
| 8 | M | 48 | OD | arrow | PPL,PPV,FB removal,EL,C3F8 | 2 | 0.01 | 0.4 | 14.0 | 1607.8 | 18.5 |
| 9 | M | 58 | OS | pebble | CE,ASV | 2 | 0.02 | 0.4 | 9.5 | 2631.5 | 17.0 |
| 10 | F | 54 | OD | pot cracker | CE,ASV | 1 | 0.01 | 0.3 | 11.0 | 2264.8 | 19.5 |
| 11 | M | 63 | OD | wooden stick | CE,PPV,EL,C3F8 | 2 | 0.02 | 0.6 | 9.5 | 2488.0 | 16.5 |
| 12 | M | 42 | OS | pebble | CE,ASV | 3 | 0.02 | 0.3 | 9.5 | 1090.0 | 18.0 |
| 13 | M | 37 | OD | iron stick | PPL,PPV,EL,C3F8 | 12 | 0.06 | 0.4 | 12.5 | 2265.2 | 19.0 |
| 14 | M | 42 | OD | scrap iron | PPL,PPV,EL | 3 | 0.02 | 0.2 | 7.0 | 2272.0 | 13.0 |
| 15 | F | 21 | OD | wooden stick | CE,ASV | 12 | 0.05 | 0.3 | 11.5 | 2516.9 | 15.0 |
| 16 | F | 59 | OD | fire cracker | CE,ASV | 1 | 0.04 | 0.6 | 12.75 | 2069.0 | 18.5 |
| 17 | M | 57 | OS | wooden stick | PPL,PPV,EL | 1 | 0.02 | 0.3 | 12.0 | 2045.9 | 15.5 |

Abbreviation:ASV, anterior segment vitrectomy; BCVA, best corrected visual acuity ; CE, cataract extraction ; DO, deuterium oxide; ECD, endothelial cell density ; EL, endolaser; F, female; FB, foreign body; IOL, intraocular lens; M, male; OD, right eye; OS, left eye; PPL, pars plana lensectomy; PPV, pars plana vitrectomy; UCVA, uncorrected visual acuity.

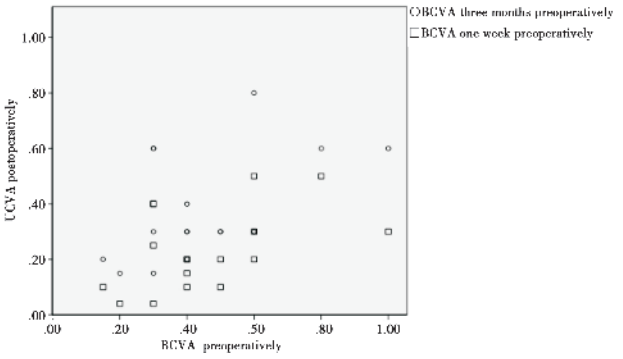


**Figure 1** Visual acuity before and after surgery

**Table 2** Clinical data of the anterior chamber by OCT

| Patient | ACD(mm) | | Pupil diameter(mm) | | Site of iris | Haptic position |
|---|---|---|---|---|---|---|
| No. | Pre | Post | Pre | Post | suture | |
| 1 | 3.61 | 2.65 | 5.37 | 3.08 | 10;00 | 3;00,9;00 |
| 2 | 3.8 | 2.83 | 6.02 | 3.91 | 10;00 | 2;00,8;00 |
| 3 | 3.47 | 3.16 | 6.27 | 4.08 | 9;00 | 4;00,10;00 |
| 4 | 3.42 | 3.04 | 6.76 | 4.06 | 11;00 | 3;00,9;00 |
| 5 | 2.98 | 2.73 | 5.61 | 4.09 | 12;00 | 3;00,9;00 |
| 6 | 3.27 | 2.25 | 5.33 | 3.45 | 11;00 | 3;00,9;00 |
| 7 | 3.2 | 2.18 | 5.21 | 3.75 | 11;00 | 3;00,9;00 |
| 8 | 2.88 | 2.09 | 5.18 | 4.07 | 11;00 | 3;00,9;00 |
| 9 | 3.11 | 2.12 | 5.45 | 3.78 | 10;00 | 3;00,9;00 |
| 10 | 3.24 | 2.31 | 6.23 | 4.38 | 12;00 | 3;00,9;00 |
| 11 | 4.31 | 2.97 | 5.23 | 3.6 | 11;00 | 3;00,9;00 |
| 12 | 3.33 | 2.57 | 5.34 | 3.18 | 5;30 | 2;00,8;00 |
| 13 | 3.22 | 2.16 | 5.06 | 2.94 | 11;00 | 3;00,9;00 |
| 14 | 3.41 | 2.32 | 5.32 | 3.81 | 8;00 | 5;00,11;00 |
| 15 | 3.62 | 2.58 | 5.42 | 3.26 | 12;30 | 3;00,9;00 |
| 16 | 3.28 | 2.34 | 5.72 | 3.5 | 9;30 | 3;00,9;00 |
| 17 | 3.24 | 2.16 | 6.95 | 3.52 | 12;00,6;00 | 3;00,9;00 |

Abbreviation: ACD=anterior chamber depth; Pre=preoperatively; Post=postoperatively.

anterior segment vitrectomy or pars plana vitrectomy were performed before IOL implantation (Table 1).

At 3-month follow-up, mean UCVA improved from(0.02±0.01) preoperatively to (0.37±0.19) postoperatively ($t$ =−7.57, $P$ <0.05). Mean BCVA increased from (0.46±0.22) preoperatively to (0.54±0.21) postoperatively ($t$=0.69, $P$>0.05). Only six patients showed better postoperative UCVA than preoperative BCVA.

Most patients reported no signs of photophobia and glare after surgery. However, three patients wore sunglasses to avoid such symptoms.

Mean IOP decreased from (12.5±5.3 mmHg) preoperatively to (10.4±2.8 mmHg) at 1 week postoperatively ($t$ =2.01, $P$ =0.061). Average loss of ECD was 336.06 cells/mm$^2$ (2166.95 ±424.67 cells/mm$^2$ preoperatively vs 1830.89±634.01 cells/mm$^2$ postoperatively).

Pupil size and ACD were measured by anterior segment OCT. The horizontal and vertical pupil lengths were averaged as pupil diameter. ACD was measured from the central cornea endothelium to midpoint surface of pupil before operation or to the anterior surface of artisan IOL after surgery. The mean pupil size was decreased by 2.00 mm (5.67± 0.57 mm preoperatively vs 3.67±0.41 mm postoperatively, $t$=15.35, $P$<0.05). Mean ACD declined by 0.88 mm(3.38±0.33 mm preoperatively vs 2.50±0.35 mm postoperatively, $t$=12.16, $P$<0.05).

Iris tear was noted in three patients when suturing the pupil edge. So, the suture site was changed. Two patients developed anterior chamber hemorrhage disappearing after receiving hemostasis drugs for three days. One case presented with severe corneal edema induced by low ECD, which was alleviated one week later after using drops of dexamethasone. No significant IOL displacement, claw luxation, corneal decompensation or endothalmitis was seen except one patient developed recurrent retinal detachment. His final visual acuity achieved > 0.2 after undergoing deuterium oxide exchange, endolaser and C3F8 tamponade.

## Discussion

Aphakia can be corrected by multiple means such as wearing contact lenses/glasses and IOL implantation. IOL implantation acts as the first choice due to its inconvenience and aberration. In the absence of adequate capsule support, IOL should be fixated by other ways, for instance, angle supported, trans-sclerally sulcus sutured or iris fixated.

An angle supported anterior chamber IOL can be easily completed. Considering long-term complications such as peripheral iris adhesion, secondary glaucoma and corneal decompensation[1-3], this surgery has been rarely utilized recently. Trans-sclerally sulcus sutured posterior chamber IOL is the only IOL resembling the position of human eyes. But it is a complicated procedure requiring more surgical time. In addition, it also correlates with a high incidence of vitreous hemorrhage, retinal detachment, cystoids

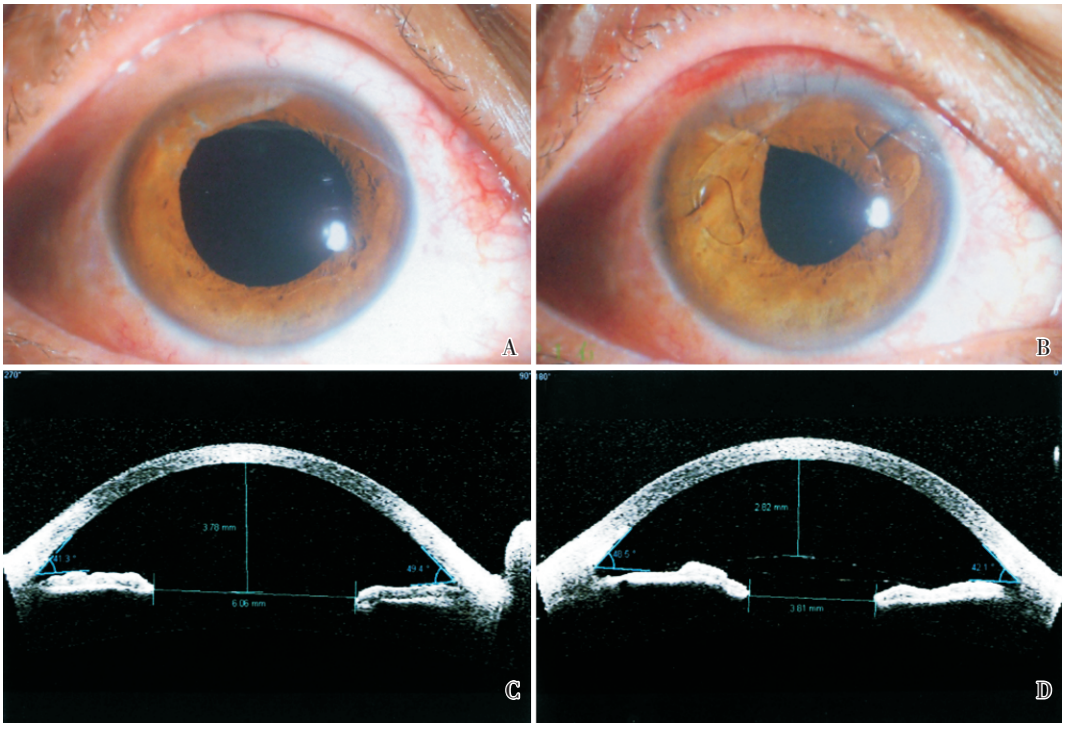


**Figure 2** A: Mydriasis and aphakia induced by blunt trauma after lens removal and anterior vitrectomy. C: Pupil diameter was 6.06 mm and ACD was 3.78 mm measured by anterior segment OCT preoperatively. B: One patient′ eye after coreoplasty and Artisan IOL implantation. D: Pupil diameter was 3.81 mm and ACD was 2.82 mm measured by anterior segment OCT postoperatively.

macular edema, and lens tilting, etc[4,5].

Artisan IOL was first invented by Jan Worst in 1986, as a new version of the iris fixated anterior chamber IOL. Until recently, iris-supported lenses have been increasingly modified to correct aphakia or high refractive phakia[6-9]. It has also been widely used in traumatic aphakia eyes[10,11].

Mydriasis is a common complication of traumatic injury occurring after primary treatment. Iris incarcerated to the corneal wound or dislocated cataract decreased pupil constriction. Patients complained about incapacitating photophobia and glare. Black iris diaphragm posterior chamber IOL, or Artisan iris reconstruction implants were chosen for the treatment of aphakia eyes with traumatic partial aniridia[12,13]. Due to larger diameter and weaker haptics, black iris diaphragm posterior chamber IOL needs a larger scleral tunnel and has a higher chance of hemovitreous, IOL decentration, and haptic detachment, etc. For mild iris damages, iris suturing is a simple treatment of partial aniridia correction.

The patients with severe topical aniridia were excluded from current study. Coreaplasty was performed either at the damaged iris edge or superior iris edge. Average pupil diameter was reduced by 2.00 mm, and ACD was ⩾ 2.00 mm. Thus the pupil restore regular shape and became smaller to reduce extra light into fundus. Artisan IOL was inserted and fixated at a proper site. The visual acuity improved as photophobia and glare were aggravated. Mean UCVA was 0.37±0.19 at the last 3-month follow up. Six patients showed better postoperative UCVA than preoperative BCVA. To our knowledge, there has been no report of coreoplasty and artisan IOL implantation.

However, coreoplasty may cause iris tearing. Iris became fragile after blunt or penetrating trauma, and easy to crust when suturing the pupil edge. More than one site would be needed for cases with large wounds. Artisan IOL position is another concern. After coreoplsaty, iris tension was altered and tended to be irregular, thus, Artisan IOL failed to be fixated at a horizontal level.

In conclusion, coreoplasty and Artisan IOL im-

plantation are safe and effective to correct aphakia and mydriasis in post-traumatic vitrectomized eyes with iris support considering its simple procedure, good visual restore, improvement of photophobia and low rate of complications. However, more investigations with larger sample size and longer follow up should be performed.

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