

CASE REPORT

Xtra focus pinhole IOL (Morchers GMBH) a novel approach to tackle irregular astigmatism and large pupillary defects with a single step surgery

Prateek Agarwal, Samuel Edward Navon

Eye Institute, Cleveland Clinic
Abu Dhabi, Abu Dhabi, United
Arab Emirates

Correspondence to

Dr Prateek Agarwal,
dr.prateekagarwal@gmail.com

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SUMMARY

A 69-year-old patient presented to us with traumatic mydriasis with irregular pupil measuring 7 mm, with superior loss of iris tissue and large inferior peripheral iridotomy and pseudophakia. The patient had history of blunt trauma 3 years ago in a fire cracker injury. He was operated elsewhere primarily after the trauma for cataract surgery with intraocular lens implantation and had suboptimal visual outcome with glare and photophobia. He presented to us with irregular pupil and inferior iridectomy with pseudophakia. The uncorrected visual acuity was 20/150 improving to 20/50 with glasses. He had a history of cataract surgery with intraocular lens (IOL) implantation done elsewhere several years back. The patient was not a diabetic or hypertensive. There was a para central corneal scar causing irregular corneal astigmatism. Extra focus pinhole IOL was implanted in sulcus having a pinhole aperture 1.36 mm. Preoperative total corneal higher-order aberrations were 3.3 μ and total corneal coma was 0.97 μ . Postoperatively uncorrected distance visual acuity improved to 20/40 intermediate uncorrected visual acuity improved to 20/30 and uncorrected near visual acuity was J3.

BACKGROUND

Irregular corneal astigmatism significantly causes reduction in visual acuity and is associated with multitude of higher-order aberrations.^{1 2}

The main causes for irregular corneal astigmatism are post-trauma, keratoconus, corneal scars and postpenetrating keratoplasty.

There are various modalities for irregular astigmatism management namely topo-guided laser and rigid gas permeable contact lenses.² Traumatic mydriasis may be treated with pupilloplasty³/iris prosthetic devices.⁴

Ocular aberrations are directly proportion to the pupil diameter. Reducing the pupil diameter minimises the higher-order aberrations.⁵

Extra focus pinhole IOL addresses both irregular astigmatism as well as pupillary defects. This case presents a novel approach to tackle irregular pupil as well as irregular astigmatism with a single step surgery.

CASE PRESENTATION

A 69-year-old patient presented to us with history of blunt trauma 3 years ago in a fire cracker injury. He was operated elsewhere primarily after the trauma for cataract surgery with intraocular lens implantation and had suboptimal visual outcome with glare and photophobia and presented to us with irregular pupil and inferior iridectomy with pseudophakia.

Irregular pupil measuring 7 mm with superior loss of iris tissue and large inferior peripheral iridotomy and pseudophakia (figure 1). The patient was not a diabetic or hypertensive. There was a paracentral corneal scar away from visual axis. The uncorrected visual acuity was 20/150 improving to 20/50 with glasses. Our patient tried cosmetic contact lens before presenting to us as advised by the primary surgeon after the surgery but he developed allergy and intolerance to it after few months.

INVESTIGATIONS

Intraocular pressure were within normal limits measuring 18 mm Hg. The gonioscopy findings showed open angles with the visible scleral spur in all four quadrants. There were few peripheral anterior synechiae in the inferior quadrant for three clock hours. There was no angle recession.

Corneal topography was done to quantitate irregular astigmatism and higher-order aberrations. Preoperative total corneal higher-order aberrations were 3.3 μ and total corneal coma was 0.97 μ . Ultrasound bio microscopy was done to ensure adequate anterior chamber depth more than 3.5 mm for sulcus implantation of XtraFocus IOL and rule out any irido-capsular adhesions and making sure the pre-existing IOL is in the bag. Anterior chamber depth in our case was 3.65 mm.



Figure 1 Irregular pupil with loss of superior iris tissue and inferior peripheral iridectomy with pre-existing IOL.



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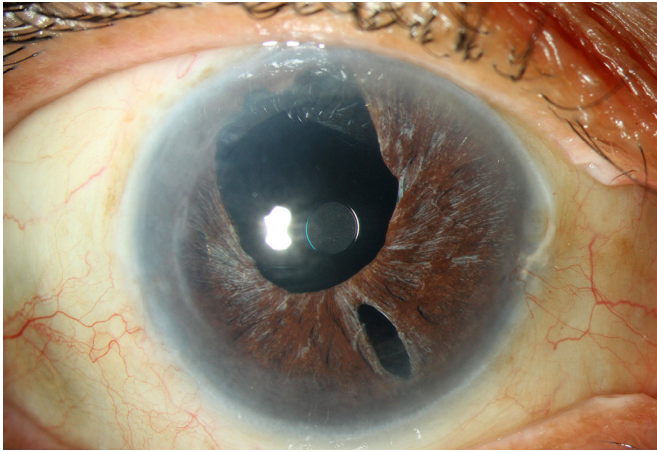


Figure 2 Postsurgery showing well-centred xtra focus pinhole IOL.

Preoperative slit-lamp photograph was taken. Dilated fundus examination was done. The fundus examination was within normal limits the peripheries normal without any retinal breaks or retinal pathology.

We planned to proceed with the surgery, 3 years and 3 months after the primary trauma.

Differential diagnosis

Irido-corneal endothelial syndrome.

TREATMENT

Under topical and monitored anaesthesia care 2.4 mm temporal clear corneal incision was fashioned. Anterior chamber was filled with ophthalmic visco surgical device provisc and the extra focus pinhole IOL was implanted in the ciliary sulcus using Monarch D cartridge and Epsilon injector system. Intracameral Miochol was injected to obtain miosis and ensure proper centration of the IOL.

OUTCOME AND FOLLOW-UP

Postoperatively 1 week left eye uncorrected visual acuity improved to 20/30 intermediate uncorrected visual acuity improved to 20/30 and uncorrected near visual acuity improved to J3. The glare and photophobia resolved completely. Subjectively the patient was satisfied with the visual outcome. Slit lamp bio microscopy revealed well centred IOL (figure 2). The patient was followed up for next 6 months with stable visual acuity and lens centration.

DISCUSSION

Irregular corneal astigmatism significantly causes reduction in visual acuity and is associated with multitude of higher-order aberrations.¹²

The main causes for irregular corneal astigmatism are post-trauma, keratoconus, corneal scars and post penetrating keratoplasty.

Ocular aberrations are directly proportion to the pupil diameter. Reducing the pupil diameter minimises the higher-order aberrations.² Secondary sulcus piggyback IOL implantation corrects large refractive errors and has a long safety track record.^{6 7} Extra focus pinhole IOL addresses both irregular astigmatism as well as pupillary defects. The pinhole device has a black opaque diaphragm with a 1.34 mm central opening without any refractive power. It is implanted in the ciliary sulcus in a piggyback configuration. The haptics are thin and rounded



Figure 3 Shape and design of xtra focus pinhole IOL.

to prevent any injury to the overlying uveal tissue. The haptics are 14° angulated thereby preventing contact with uveal tissue minimising the chances of iris chaffing and pigment dispersion. The overall diameter is 14.0 mm which is larger than most IOLs thereby preventing decentration. The occlusive optic portion has a concave convex design which prevents contact with underlying IOL thereby preventing inter-lenticular opacification (figure 3).

One limiting factor will be fundus examination postoperatively as it allows only infrared light to pass through. Optical coherence tomography can be easily used to see the macula as well as confocal scanning laser ophthalmoscopy which fuses the principle of infrared light.⁸

Fundus optos imaging is also capable of taking good pictures in the presence of pinhole IOL.⁸

It is recommended that patients with active retinal pathologies likely to receive retinal intervention immediately or in near future should not be implanted with this IOL.

Contact lenses are not long term solution and people develop allergy to that with 14–16 hours of use everyday.

In conclusion XtraFocus pinhole device is a novel approach in the treatment of challenging cases presenting with irregular corneal astigmatism and concurrent iris defect with a large pupillary area.

Patient's perspective

I'm very happy after the treatment as I had lost hope after my previous surgery.

Learning points

- ▶ This case uses a novel approach to tackle a complex anterior segment pathology presenting with irregular astigmatism with concurrent iris defects with a simultaneous single step surgical approach using xtra focus pinhole IOL. Pupilloplasty and artificial iris processes can only tackle irregular pupils, without addressing irregular corneal astigmatism.
- ▶ Topo guided Laser vision correction which is use to correct irregular corneal astigmatism is limited by the availability and cost combined with unpredictable surface healing in an elderly patient. Xtra focus pinhole IOL can be used as novel approach to tackle both the pathologies simultaneously.

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REFERENCES

- Jenkins TC. Aberrations of the eye and their effects on vision: 1. Spherical aberration. *Br J Physiol Opt* 1963;20:59–91.
- Lains I, Rosa AM, Guerra M, *et al.* Irregular astigmatism after corneal transplantation--efficacy and safety of topography-guided treatment. *Cornea* 2016;35:30–6.
- Narang P, Agarwal A. Single-pass four-throw technique for pupilloplasty. *Eur J Ophthalmol* 2017;27:506–8.
- Mayer C, Tandogan T, Hoffmann AE, *et al.* Artificial iris implantation in various iris defects and lens conditions. *J Cataract Refract Surg* 2017;43:724–31.
- Applegate RA, Donnelly WJ, Marsack JD, *et al.* Three-dimensional relationship between high-order root-mean-square wavefront error, pupil diameter and aging. *J Opt Soc Am A Opt Image Sci Vis* 2007;24:578–87.
- Gayton JL, Sanders V, Van der Karr M, *et al.* Piggybacking intraocular implants to correct pseudophakic refractive error. *Ophthalmology* 1999;106:56–9.
- Meyer JJ, McGhee CN. Supplementary, sulcus-fixated intraocular lens in the treatment of spherical and astigmatic refractive errors in Pseudophakic Eyes After Keratoplasty. *Cornea* 2015;34:1052–6.
- Trindade CC, Trindade BC, Trindade FC, *et al.* New pinhole sulcus implant for the correction of irregular corneal astigmatism. *J Cataract Refract Surg* 2017;43:1297–306.

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