Intraocular lens scaffold pupilloplasty: A novel technique for pupilloplasty in phakic eyes

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Numerous techniques of pupilloplasty have been described to restore iris anatomy. However limitations arise in phakic eyes due to the propensity for crystalline lens damage. We describe a novel technique for pupilloplasty in phakic eyes, wherein a plate haptic intraocular lens or phakic intraocular lens provides a scaffold and protects the anterior crystalline lens from subsequent surgical manoeuvres. The technique is demonstrated in a 24-year-old male who presented four months following blunt trauma to his left eye, with complaints of glare and difficulty in near activities secondary to traumatic mydriasis. The use of an intraocular lens scaffold allowed successful pupilloplasty without iatrogenic tissue trauma or subsequent crystalline lens opacification up to one-year follow-up. Our technique affords a safe pupillary repair without damage to the clear crystalline lens or the need for a concomitant lens extraction.

Key words: Intraocular lens scaffold, phakic eyes, pupilloplasty, traumatic mydriasis

The physiological pupillary dimensions can be altered secondary to congenital dysgenesis or acquired conditions including iatrogenic injury and trauma. Numerous techniques of pupilloplasty have been described to restore iris anatomy, including single-pass four-throw pupilloplasty (SFT).[1] Additional indications include pupil repair to enable air tamponade in corneal endothelial transplant, Urrets Zavalia syndrome and prevention of anterior synchiae formation with secondary glaucoma sequelae.[2‑4] However, these techniques are limited to pseudophakic eyes or those with concomitant cataract due to the propensity to damage the clear crystalline lens. We demonstrate the technique of an intraocular lens (IOL) scaffold to enable pupilloplasty in phakic eyes with clear crystalline lens.

Surgical Technique

The study conformed to the tenets of Declaration of Helsinki, an Institutional Review Board approval was obtained and an informed consent was taken from the patient. A 24-year-old male presented with complaints of glare and difficulty in near activities in his left eye, secondary to a blunt trauma with a cricket ball four months prior. The uncorrected distance visual acuity in both eyes was 20/20. Anterior segment evaluation of the right eye was unremarkable. Left eye revealed traumatic mydriasis with a clear crystalline lens. Fundus evaluation and intraocular pressure in both eyes was within normal limits.

The procedure was performed under peribulbar anaesthesia using lidocaine hydrochloride (Xylocaine 2%) and bupivacaine hydrochloride 0.5% (Sensocaine) [Fig. 1a]. Two paracentesis ports were constructed perpendicular to the area of mydriasis. A 2.8mm clear corneal incision was constructed following injection of ophthalmic viscoelastic device (OVD, sodium hyaluronate 1.4%, Healon GV, Johnsons & Johnsons surgicals) into the anterior chamber. Preloaded foldable hydrophobic plate haptic intraocular lens (Acriol EC Versatile, AS-6VP, Caregroup, India) was injected into the anterior chamber and footplates were subsequently tucked under the iris [Fig. 1b]. The plate haptic protects the anterior surface of the crystalline lens and allows subsequent manoeuvres to be performed safely. A 10-0 polypropylene single arm suture on the long arm of the needle was introduced via the paracentesis port and passed through the proximal end of the mydriasis [Fig. 1c]. A 26-gauge needle was then passed through the opposite stab incision into the distal end [Fig. 1d]. The 10-0 suture needle was anchored onto the 26-gauge needle barrel and withdrawn [Fig. 1e and f]. The suture loop was pulled out of the anterior chamber and placed onto the conjunctiva using a Sinskey hook. The plate haptic IOL was subsequently explanted under OVD cover (chondroitin sulphate 4%, Viscoat, Alcon) [Fig. 1g]. The suture end was passed through the loop in four throws, and tied.

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and both ends of the suture were pulled approximating the loops inside the eye [Fig. 1h]. Suture ends were cut using micro scissors [Fig. 1i] followed by a thorough viscoelastic wash [Video 1].

Persistent glare postoperatively, warranted a secondary intervention with additive pupilloplasty after one month [Fig. 2a]. A posterior chamber phakic intraocular lens (Implantable Collamer Lens ICL V4C, Staar Surgical, Switzerland) was utilised as a scaffold [Fig. 2b]. Needle passes through the iris were made to close the inferior [Fig. 2c] and superior discontinuity [Fig. 2d]. The implant was subsequently explanted [Fig. 2c] and the loops were pulled [Fig. 2f and g] to complete the pupilloplasty [Fig. 2h].

Postoperatively, a well-rounded pupil was achieved with cessation of glare. No significant endothelial cell loss or crystalline lens opacification was noted until one-year postoperative visit. The patient retained an uncorrected distance visual acuity of 20/20.

Discussion

Treatment of iris dysfunction is aimed at restoring the pupillary aperture, thereby reducing visually disturbing light from

Figure 1: Intraocular lens scaffold pupilloplasty. (a) Traumatic mydriasis with clear crystalline lens. (b) Plate haptic intraocular lens placed as a scaffold to protect the lens from subsequent surgical manoeuvres. (c) 10-0 polypropylene suture passed through the proximal end of the iris mydriasis. (d) 26-gauge needle introduced through the opposite stab incision and passed through the distal iris leaflet. (e) Suture needle docked into the barrel of the 26 gauge needle. (f) 26 gauge needle withdrawn along with suture needle. (g) IOL explanted. (h) Suture ends pulled after four throws through loop. (i) Iris tissue approximated and suture ends cut with micro scissors.
entering the eye. Apart from functional and aesthetic issues, anisocoria can impact the psychosocial aspect of a patient’s life. Several described methods include coloured contact lenses, corneal tattoos, artificial iris implants and surgical pupilloplasty. A drawback of surgical pupilloplasty however is the possibility of damage to the clear crystalline lens, limiting its use in such eyes. Our technique overcomes this limitation as the intraocular lens provides a scaffold and protects the crystalline lens from iatrogenic needle trauma.

The plate haptic intraocular lens affords adequate coverage for the anterior surface of the crystalline lens and was utilised as the scaffold in our technique. The foldable material allows insertion and subsequent explanation via a 2.8 mm clear corneal incision with relative ease. Phakic intraocular lenses (Implantable Collamer Lens V4C, Staar Surgical, Switzerland) can be used as an alternative. The relatively pliable nature of the ICL affords implantation in smaller pupillary apertures. Additionally, the ICL structure allows it to rest on the crystalline lens peripherally with an intervening clear central space secondary to the vault. No cases of iatrogenically induced lenticular opacification were noted in our case. Larger cohorts are necessary to establish the advantage of one implant over the other.

The single-throw four-pass pupilloplasty technique entails a single anterior chamber pass limiting additional intracameral manoeuvres. This provides an advantage over other techniques and translates to reduced surgical manipulation and pigment dispersion in an already compromised eye.56 Additionally the suture line lies parallel to the iris tissue and the absence of the knot decreases the bulk of the suture, thereby reducing the risk of damage to the anterior crystalline lens and corneal endothelium. Although our technique utilises SFT as the method of pupilloplasty, a comparison of results with varied pupilloplasty methods would provide useful insight.

**Conclusion**

In conclusion, we describe a novel technique of surgical pupilloplasty in phakic eyes. Long term follow-up and larger cohorts are necessary to validate the results.

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**Conflicts of interest**

There are no conflicts of interest.

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