Surgical Technique

Bimanual technique for placement of footplates of phakic intraocular lens in eyes with intraoperative miosis

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We describe and assess the efficiency of a novel technique of placing implantable collamer lens (ICL) footplates in the sulcus in poorly dilated pupils utilizing perioptic holes and two instruments simultaneously (Sinskey hook and ICL manipulator). Twelve eyes of 10 patients underwent ICL implantation through this technique. The technique employs a bimanual approach engaging perioptic holes in the eyes with intraoperative miosis. Perioptic holes were engaged with a Sinskey hook and pulled slightly back, while the footplates were tucked under the iris by using an ICL manipulator. All patients had uneventful surgery. At 1 week follow-up, uncorrected distance visual acuity (UCDVA) was −0.01 ± 0.04 logMAR with a mean vault of 606.17 ± 108.33 microns. No complications were noted. However, too small a pupil is a limiting factor; this technique can be of use in up to mid-dilated pupils. Bimanual placement of haptics of ICL may represent a safe and effective technique in insufficient mydriasis or intraoperative pupillary miosis.

Key words: Implantable collamer lens (ICL), miosis, phakic intra-ocular lens

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Corneal refractive surgery, phakic intraocular lens (PIOL), and refractive lens exchange are the major management options available for the treatment of high ametropia. For high refractive errors that are not suitable for kerato-refractive surgery, refractive lens exchange (RLE) and PIOL can be considered. RLE is usually not considered in nonpresbyopic individuals as it results in loss of accommodation along with its other potential complications. Benefits of PIOL include the preservation of accommodation, relatively lower induction of higher-order aberrations, and the advantage of reversibility.[1-3]

The Visian ICL (STAAR Surgical, Nidau, Switzerland) is a rectangular one-piece plate-haptic design lens that is plano-concave with two perioptic holes.[4] The V4c or EVO model has a central port or hole of 0.36 mm (KS-Aquaport), which allows aqueous flow and eliminates the need for iridotomy or iridectomy that was required in earlier models.[5] The additional perioptic holes also aid in the aqueous flow.[6] The posterior chamber phakic intraocular implantable collamer lens (ICL) has a good safety and efficacy profile in surgical correction of high ametropia.[7]

A few commonly encountered difficulties during implantation include the inverse opening of the ICL in the anterior chamber, inadvertent touch to the lens or corneal endothelium due to slippage of the ICL manipulator while tucking of footplates in the sulcus, and pupillary constriction due to mechanical stimulation of iris making it further difficult to tuck the footplates under the iris.[8]

To the best of our knowledge, there is no published literature on how to deal with the challenging situation of intraoperative pupillary constriction, which makes it difficult to place the footplates under the iris. We describe a bimanual technique to safely and effectively place the footplates behind the iris in such conditions.

Materials and Methodology

This was a prospective pilot study describing a new surgical technique in a series of ten patients and was conducted at our tertiary eye care center, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, India. The study was approved by the institute's ethics committee (Ref. No. IEC/PG-594/07.11.2022, RT-35/17.11.2022). This study was HIPAA-compliant and adhered to the tenets of the Declaration of Helsinki. A written informed consent was obtained from each patient before the enrolment.

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The ICL (EVO Visian, STAAR Surgical, Nidau, Switzerland) was loaded into the cartridge. The cartridge was first coated and filled with 2% hydroxypropyl methylcellulose (Appavisc PFS, Appasamy Associates). The ICL was placed onto the trough, grasped by grasping alligator forceps, and the cartridge was pulled onto the opposite side to bring the folded ICL close to the tip of the cartridge. Once the ICL was loaded, corneal paracentesis was made at 7 and 11 o'clock positions while performing the procedure in the right eye and 5 and 1 o'çlock positions while performing in the left eye, and a temporal 2.8-mm clear corneal incision was created under topical anesthesia with proparacaine hydrochloride 0.5%. The anterior chamber was filled with 2% hydroxypropyl methylcellulose (Appavisc PFS, Appasamy Associates). A surgical plan was made for the implantation and positioning of footplates [Fig. 1a–d]. The ICL was injected into the anterior chamber over the iris by using the wound-assisted approach [Fig. 2a]. Some viscoelastic was injected over the ICL, and the ICL was further tapped down gently with the viscoelastic cannula. A Sinskey hook and an ICL manipulator were inserted through the two paracentesis ports. The Sinskey hook was used to engage the nasal perioptic hole, the ICL was pulled slightly backward temporally, and the nasal footplates were tucked under the iris by using an ICL manipulator [Fig. 2b–d]. The Sinskey hook was then used to engage the temporal perioptic hole, and the ICL was pushed nasally, thereby bringing the temporal footplates toward the center, and then the footplates were gently pushed behind the iris, thereby placing the ICL finally under the iris in the sulcus [Fig. 2e–h]. The technique was effectively and safely performed in 12 eyes of 10 patients with insufficient mydriasis or intraoperative miosis without any complication [Video 1]. Postoperatively, the patients were prescribed topical moxifloxacin hydrobromide 0.5% TID and prednisolone phosphate 1% eye drops QID.

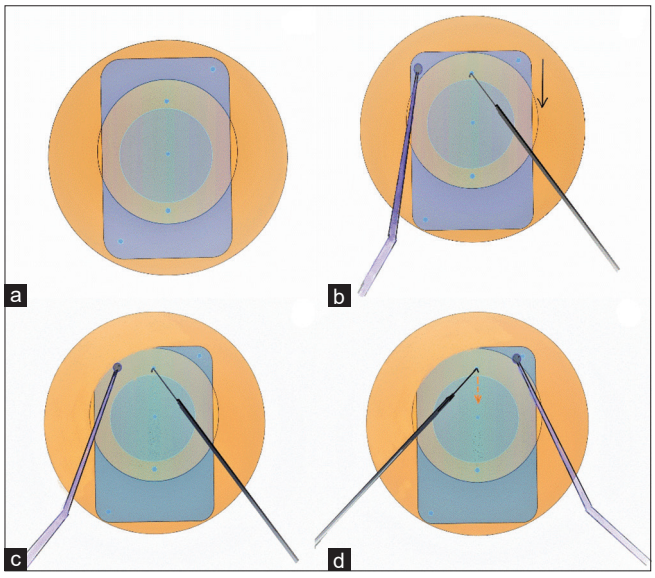

Figure 1: Diagrammatic representation of the bimanual approach of ICL placement under the iris. ICL is placed above the iris plane in the mid-dilated pupil (a). The Sinskey hook held in the right hand engaged the nasal perioptic hole and pulled it temporally, and the footplate on the superonasal side was tucked using an ICL manipulator in the left hand (b and c). The hands were changed, and the same maneuver was done for tucking the inferonasal footplate (d)

Results

The case series comprised 12 eyes of 10 patients: six females and four males, with a mean age of 24.41 ± 2.71 years (range: 21–29 years), of which five eyes had preoperative insufficient mydriasis, while seven eyes were noted to have intraoperative pupillary miosis during tucking of ICL footplates in the sulcus due to mechanical stimulation of iris tissue.

The postoperative uncorrected distance visual acuity (UCDVA) on day 1 was 0.05 ± 0.07 logMAR with a mean intraocular pressure (IOP) of 18.5 ± 2.73 mmHg. A mild anterior chamber reaction was noted without any iris abnormality or lenticular change. The mean vault was 645.67 ± 121.80 microns.

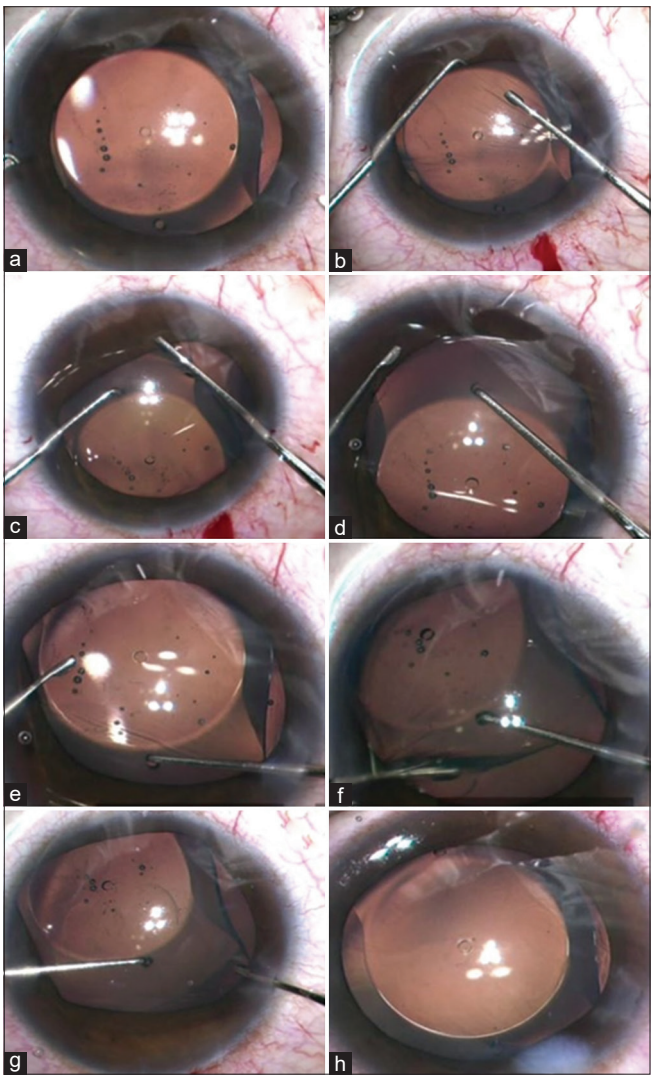

Figure 2: The ICL was injected and placed above the iris plane (a). The Sinskey hook and ICL manipulator were inserted through paracentesis ports, the nasal paraoptic hole was engaged with the Sinskey hook and pulled slightly back, and both nasal footplates were tucked under the iris by using ICL manipulator (b–d). A similar method of hooking and pulling with Sinskey hook and placing the footplate in the sulcus with an ICL manipulator was done on the temporal side (e–g). The ICL was finally placed under the iris in the sulcus (h)

At 1 week follow-up, UCDVA was −0.01 ± 0.04 logMAR with a mean vault of 606.17 ± 108.33 microns and an IOP of 15.55 ± 1.21 mmHg. No cataractous change was observed in any of the eyes.

During manipulation, no damage to the ICL footplate and optic plate or any other significant intraoperative complications was noted. The duration of surgery was 4.92 ± 1.07 minutes, which was similar to the standard ICL implantation procedure.

Discussion

The traditionally used method of ICL insertion and tucking in well-dilated pupils includes the use of an ICL manipulator through the paracenteses in one hand and a globe-stabilizing instrument in the other.[5] In other words, this can be described as a "one-handed approach" to tucking footplates. This method often fails to slip ICL haptics easily under the mid-dilated pupil and unduly prolongs the surgery, thus increasing the risks associated with it. It has also been seen that often less experienced surgeons struggle to place the ICL foot plate haptics under the iris, and increased manipulation can cause the iris to constrict further due to mechanical stimulation, making it even harder for them to place it in the sulcus smoothly. This initial learning curve of the surgeons is also one of the factors of early cataracts in the postoperative period.[2,9]

Adapting our surgical approach in such technically difficult situations is important to optimize surgical outcomes. Dealing with poorly dilated pupils and their management have been extensively discussed in the literature for phacoemulsification surgery, but we find a big lacuna in the literature for ICL surgery in such conditions.[10]

To address the challenging situation of small pupils during ICL implantation, we developed a technique that uses a bimanual approach for laying down the haptics under the iris. We named this technique the "bimanual technique of footplate placement." The perioptic holes were utilized in this technique. Two perioptic holes are present on either side beyond the central 6-mm optical zone, and they facilitate ocular viscoelastic device removal during the surgery and complement the central optic hole for aqueous flow.[7] The Sinskey hook does not pass through the full thickness of the perioptic hole; hence, there is no risk of damage to the crystalline lens. Deploying these holes for surgical maneuvers can also be useful and safe as they lie beyond the central 6-mm optic zone.

This technique can facilitate ICL implantation in conditions such as poorly dilated pupils and intraoperative pupillary miosis. In addition, this can be used by inexperienced surgeons who struggle to tuck the haptics under the iris during the initial part of their learning curve. We found that using this approach helped us to place the plate haptics of ICL under the iris plane smoothly. Furthermore, it helped us avoid undue prolongation of the surgery. The bimanual approach allows the safe placement of the haptics into the sulcus without any resultant iris deformity or endothelial or crystalline lens injury.

To conclude, this technique is safe and effective in poorly dilated pupils in newer as well as in experienced hands.

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Conflicts of interest: There are no conflicts of interest.

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