Surgical Technique

Swivel haptics anterior capsule-fixated intraocular lens

Sri Ganesh, Sheetal Brar

The purpose of the study is to report the feasibility of implantation of a new design of anterior capsule-fixated intraocular lens (IOL). The new IOL design is a foldable, hydrophilic, open-loop posterior chamber IOL with two extra polymethyl methacrylate swivel haptics created on the optic surface to capture the anterior capsulotomy after the IOL is implanted in the bag. In the pilot phase, the new IOL was implanted in 10 eyes of 10 patients of which 8 eyes underwent phacoemulsification and 2 eyes had laser cataract surgery. The mean spherical equivalent changed from +1.75 D to −0.75 D at 6 months. Postoperatively, from 1 week to 6 months, all eyes showed stable refraction and anterior chamber depth with no evidence of decentration. Subjective questionnaire revealed high patient satisfaction with no complaints of dysphotopsia. No intra- or postoperative complications such as swivel haptic breakage, iris chafing, pigment dispersion, postoperative uveitis, or endophthalmitis occurred in any of the eyes necessitating explantation of the IOL. The new IOL design was feasible to implant and provided satisfactory outcomes in terms of no dysphotopsias and stable effective lens position.

Key words: Capsule fixation, dysphotopsia, effective lens position, posterior chamber intraocular lens, swivel haptics

Video Available on: www.ijo.in

Access this article online

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_665_17

Quick Response Code:

Modern day cataract surgery has become a refractive surgery as patients desire spectacle-free vision postoperatively. Most of the variables influencing postoperative refraction have been overcome by advancement in keratometer, optical biometer, and newer generation intraocular lens (IOL) calculation formulae.[1,2] However, refractive surprises, IOL tilt, rotation, decentration, posterior capsule opacification (PCO), and dysphotopsia continue to be the causes of patient dissatisfaction after a perfect cataract surgery.[3]

To overcome these problems, various capsule fixation lenses have been investigated.[4-6] However, some of these IOL designs may be associated with intra- and postoperative complications such as capsulotomy tears, capsular block, iris chafing, and pigment dispersion. Other potential limitations could be difficult and incomplete removal of ocular viscoelastic device (OVD) from the bag behind the IOL, complicated designs, and need for special injectors.

Surgical Technique

Concept of a new design of capsule fixation intraocular lens

The new IOL design is a single piece, open-loop, hydrophilic acrylic IOL with 6-mm aspheric optic, bearing a 360° square edge, and an overall diameter of 13 mm. The lens has two extra haptics on the optic at 3 and 9 o'clock positions made of polymethyl methacrylate, which can swivel over a pivot. The technical specifications of the IOL design have been provided in Table 1. The study was approved by the institutional ethics committee of our hospital, and informed consent was obtained by all patients participating in the study.

Preoperative considerations and biometry: The IOL power is calculated using the IOLMaster 700 (Carl Zeiss Meditec, Germany) using the SRK/T formula. The recommended A-constant used for the new lens is 117.5, considering a relatively anterior position of the IOL compared to in the bag IOLs, where generally, the A-constant used is between 118.2 and 118.7.

The new IOL design is suitable for implantation following a routine phacoemulsification or femtolaser-assisted cataract surgery. The most important prerequisite for implantation of this lens is an intact, circular, and continuous curvilinear capsulorhexis between 5.0 and 5.5 mm size. Relative contraindications for implantation of this lens are too small or too large capsulotomy, uneven or eccentric capsulotomy, torn capsulotomy, moderate-to-severe pseudoexfoliation, and intraoperative posterior capsule rupture or zonular dehiscence associated with vitreous loss.

Loading and implantation of the IOL [Video 1]: The IOL can be implanted using a regular pusher type injector through a 2.8-mm incision. While loading, both the swivel haptics are rotated and folded on to the optic using a Sinskey hook while aligning them parallel to the longitudinal axis of the IOL. The IOL is then loaded in the cartridge while maintaining this alignment and then injected into the eye through a standard 2.8-mm incision. First, the optic with all the four haptics is positioned

Department of Phaco and Refractive, Nethradhama Superspeciality Eye Hospital, Bengaluru, Karnataka, India

Correspondence to: Dr. Sheetal Brar, Nethradhama Superspeciality Eye Hospital, 256/14, Kanakapura Main Road, 7th Block, Jayanagar, Bengaluru - 560 070, Karnataka, India. E-mail: brar_sheetal@yahoo.co.in

Manuscript received: 01.08.17; Revision accepted: 23.05.18

Cite this article as: Ganesh S, Brar S. Swivel haptics anterior capsule-fixated intraocular lens. Indian J Ophthalmol 2018;66:1307-9.

in the bag. After this, two Sinskey hooks are introduced – one from the main port and another from a side port to maneuver the IOL. The side port hook is used to gently push the optic toward the center and stabilize it, while the main port hook is used to rotate the swivel haptic and capture it onto the capsulotomy. In a similar manner, the second swivel haptic is also fixated to the capsulotomy on the other side. Viscoelastic is then aspirated from the anterior chamber and the bag by gently tapping on the surface of the IOL. Folds in the posterior capsule at the end of surgery indicate that most of the viscoelastics have been removed from the bag. Stability of the IOL is checked on the table. On completion of surgery, wound is hydrated and sealed.

Results

In the pilot phase of the study, 10 eyes of 10 patients were implanted with the new lens and followed up for 6 months. The spherical equivalent changed from a mean of +1.75 D to −0.75 D.

Initial experience suggested that the IOL was feasible and safe to implant without any intraoperative complications of capsulotomy tears, haptic stuck, dislocation, or breakage while capturing the swivel haptic on to the capsulotomy. None of the lenses were explanted.

Postoperatively, dilated clinical photography showed stable position of the lens and swivel haptics with no evidence of decentration. Fig. 1 shows the clinical photographs of an eye implanted with the new IOL following routine phacoemulsification at 2-week and 6-month follow-up. The position of swivel haptics appeared to be stable over time without any significant tilt or decentration as seen on slit lamp photography. Anterior chamber depth (ACD) measured with IOLMaster 700 also showed no significant change at 6 months (4.23 mm) compared with 2-week follow-up (4.20 mm). Ultrasound biomicroscopy (UBM) demonstrated the effective lens position (ELP) to be more anterior and just behind the iris plane as compared to conventional in the bag lenses, where it is expected to be more posterior [Fig. 2]. Tilt was not measured; however, we used the ray tracing aberrometry to study the internal optics of these eyes. The presence of high internal coma is suggested to be an indirect evidence of the tilt of the IOL. None of the eyes showed evidence of high internal coma aberrations over time and at the last follow-up, indicating good stability of IOL position.

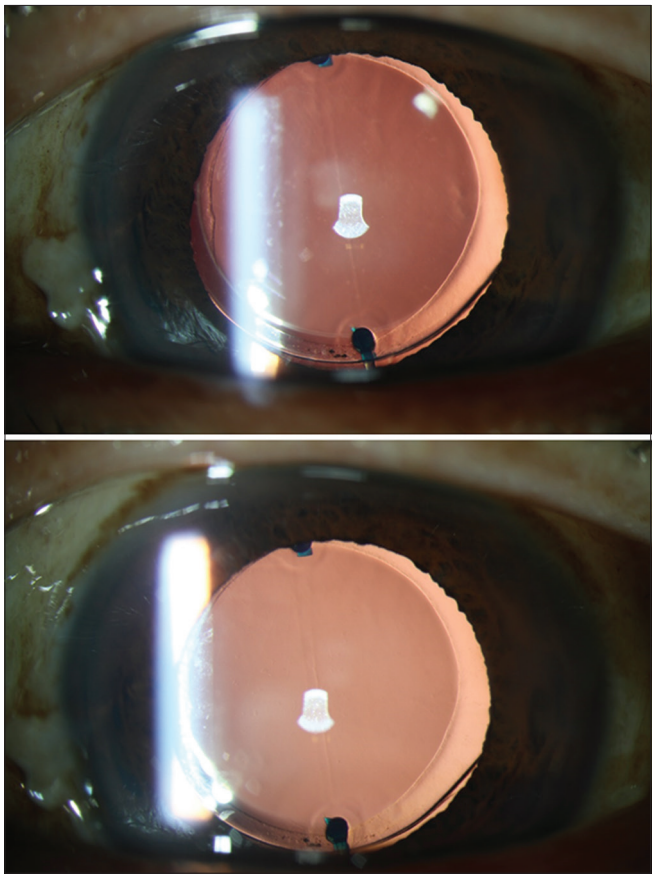

Figure 1: Clinical photograph of an eye at 2 weeks (top) and 6 months (bottom) after implantation of the swivel haptics capsule fixation IOL showing a stable position of IOL, without any rotation, tilt, or decentration

No evidence of iris chafing, pigment dispersion, secondary glaucoma, capsular block syndrome, or PCO was observed in any of the eyes implanted with the new IOL at the end of 6 months. We also did not have any case of postoperative uveitis or endophthalmitis. The swivel haptic assembly is sterile and is unlikely to prove as a nidus for infectious organisms or inflammatory cells.

Discussion

The new swivel haptics anterior capsule-fixated IOL design potentially overcomes most of the limitations of the previously introduced capsulotomy fixation IOLs. Bag-in-the-lens (BIL, Morcher GmbH, Stuttgart, Germany) was the first capsulotomy-fixated IOL introduced in 2006, mainly for the purpose of obviating the need of Yag laser capsulotomy.[4] The long-term outcomes in adult and pediatric eyes showed the IOL to be safe for implantation and effective for reducing the incidence of PCO. However, the surgical technique involved placement of the anterior and posterior capsules in the IOL's groove after a capsulorhexis of the same size created in both capsules using a special anterior capsulorhexis ring

Table 1: Specifications of the new "swivel haptics capsulotomy-fixated intraocular lens"

Optic characteristics	
Powers	+18 D—+24 D
Diameter (mm)	6
Shape	Aspheric
Material	UV-blocking hydrophilic acrylic
Refractive index	1.462 at 35°C
Edge design	360° square edge
Haptic characteristics	
Overall length (mm)	13
Fixed haptics	
Design	Open/C-loop
Material	Hydrophilic acrylic
n	2
Movable (swivel) haptics	
Design	Straight
Material	PMMA
n	2
Length (mm)	2
Optical A-constant	117.5

PMMA: Polymethyl methacrylate, UV: Ultraviolet

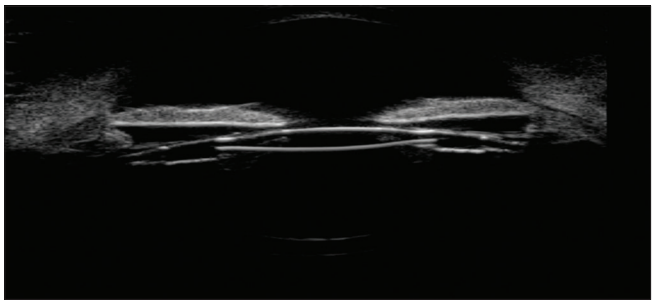

Figure 2: Ultrasound biomicroscopy of an eye at 2-week postimplantation of the swivel haptics capsule fixation IOL showing the effective lens position of IOL to be just behind the iris and much anterior compared to conventional in the bag implantation

caliper.[7] Therefore, this surgical technique appears to be more challenging, thus requiring a higher degree of surgical skill.

The 90F IOL (Morcher GmbH, Stuttgart, Germany) has the design of a C-loop IOL with an additional flank. In contrast to the femtosecond laser-assisted in-the-bag lens technique, only the anterior capsule is fixated in the side flank, whereas the posterior capsule is kept intact and the IOL is implanted in the capsular bag.[5] However, the risk of tearing of capsulotomy or capsular block syndrome still needs to be evaluated with this lens. The new swivel haptics anterior fixated IOL by virtue of its simple design and lesser manipulation of the capsulotomy may be potentially associated with lesser risk of capsulotomy tears. Furthermore, observation of folds in the posterior capsule at the end of surgery suggested, almost a complete removal of OVD, minimizing the chances of capsular block syndrome due to OVD retention in the postoperative period.

Preussner *et al*. emphasized that knowledge of postoperative ACD is important to accurately predict the postoperative IOL position and refraction.[8] This, however, cannot be easily predicted as the capsular bag size differs in individuals, and there is a variable degree of capsular contraction over time. Following the new IOL implantation, however, the IOL position is shown to be just behind the iris (on UBM) due to capsule fixation, negating the influence of bag size on ELP to a great extent. This may help better prediction of postoperative ACD, based on which the A-constant can be refined for improving predictability of postoperative refraction. Thus, a stable fixation and ELP may be achieved which may not be influenced by capsular changes overtime.

The A-constant of 117.5 was derived looking at our postoperative results of the first 3 cases. The company recommended A-constant was 118.4, and we were getting myopic shift of nearly one Diopter. However, we still need to do fifty eyes to further optimize the A-constant.

According to one of the theories, negative dysphotopsias (NDs) were more likely to develop in postoperative eyes in which there was a larger distance between the back of the iris and the anterior capsule of the lens.[9] Since the new IOL is captured onto the anterior surface of the capsulotomy, it brings the IOL position more anterior compared to the bag lenses, thus reducing the distance between back of the iris and anterior lens capsule, consequently preventing ND. The Masket™ ND IOL also negates dysphotopsia essentially by allowing for the implant to be capsule bag fixated by providing a flange of the anterior optic edge to override the anterior capsulotomy, thus minimizing the gap between iris and anterior capsule.[6]

The swivel haptic is placed 0.5 mm inside from the optic edge on both sides. Since the overall diameter of the optic is 6 mm, the effective optic size would be 5 mm. It is unlikely to interfere in night vision; as the average pupil size, postcataract surgery comes down to approximately 3–4 mm, which would not dilate more than 5 mm in scotopic conditions.

Regarding the occurrence of PCO, it may be proposed that the incidence of PCO with new swivel haptic IOL may be similar to the conventional in the bag IOLs. This may be due to the uniform shrink wrap effect and the 360° square edge of the IOL optic preventing the lens epithelial cells to migrate and proliferate toward the optical center.[10]

Other potential advantages are simple design and easy to manufacture and pack, can be used with standard injector through 2.8-mm incision, and need no special instruments or surgical training. Furthermore, the swivel haptic fixation ensures rotational stability which may provide a significant advantage for toric designs, irrespective of bag size. Finally, the IOL is easy to explant by simple disengagement of the swivel haptics, if required.

Conclusion

Our initial experience with the new IOL with swivel haptic capsule fixation suggests that it may be a safe and feasible alternative to the conventional posterior chamber IOL designs potentially providing a stable IOL position and low incidence of dysphotopsia and without any visually threatening intra- or postoperative complications. However, we need more data and longer follow-ups to evaluate the long-term safety and stability of this new design of IOL.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Cooke DL, Cooke TL. Comparison of 9 intraocular lens power calculation formulas. J Cataract Refract Surg 2016;42:1157-64.
2. Shajari M, Cremonese C, Petermann K, Singh P, Müller M, Kohnen T, *et al.* Comparison of axial length, corneal curvature, and anterior chamber depth measurements of 2 recently introduced devices to a known biometer. Am J Ophthalmol 2017;178:58-64.
3. Woodward MA, Randleman JB, Stulting RD. Dissatisfaction after multifocal intraocular lens implantation. J Cataract Refract Surg 2009;35:992-7.
4. Tassignon MJ, De Groot V, Vrensen GF. Bag-in-the-lens implantation of intraocular lenses. J Cataract Refract Surg 2002;28:1182-8.
5. Dick HB, Schultz T. Intraocular lens fixated in the anterior capsulotomy created in the line of sight by a femtosecond laser. J Refract Surg 2014;30:198-201.
6. Masket S, Fram NR. Pseudophakic negative dysphotopsia: Surgical management and new theory of etiology. J Cataract Refract Surg 2011;37:1199-207.
7. Tassignon MJ, Rozema JJ, Gobin L. Ring-shaped caliper for better anterior capsulorhexis sizing and centration. J Cataract Refract Surg 2006;32:1253-5.
8. Preussner PR, Wahl J, Weitzel D, Berthold S, Kriechbaum K, Findl O, *et al.* Predicting postoperative intraocular lens position and refraction. J Cataract Refract Surg 2004;30:2077-83.
9. Henderson BA, Geneva II. Negative dysphotopsia: A perfect storm. J Cataract Refract Surg 2015;41:2291-312.
10. Schmidbauer JM, Escobar-Gomez M, Apple DJ, Peng Q, Arthur SN, Vargas LG, *et al.* Effect of haptic angulation on posterior capsule opacification in modern foldable lenses with a square, truncated optic edge. J Cataract Refract Surg 2002;28:1251-5.