Surgical Technique

Jagat and Bala intraocular lens supporting system: An artificial platform for intraocular lens implantation in an aphakic patient with inadequate capsular support

Balamurugan R, Jagat Ram, Ganesh S[1], Savleen Kaur, Parul Chawla Gupta, Ranjan Behera

We describe a novel device, Jagat and Bala Intraocular lens Supporting System (JBISS), an artificial Intraocular lens (IOL) platform that facilitates IOL fixation in an aphakic patient with poor capsular support and also facilitates IOL exchange in case of myopic shift or refractive surprise. Implantation of JBISS along with IOL was carried out in four patients and results are promising without any adverse events.

Key words: Artificial capsular bag, artificial intraocular lens supporting device, exchangeable IOL device, IOL exchange, IOL supporting platform, scleral fixation of IOL in aphakia

Video available on:
www.ijo.in

Access this article online

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_3240_20

Quick Response Code:

There are various surgical techniques available for implanting intraocular lens (IOL) in an aphakic patient like Transcleral fixation of IOL (TSFIOL), Glued TSFIOL, and Yamane technique.[1] All the above techniques are generally meant to be one-time procedure and an attempt to exchange the scleral fixated IOL in case of myopic shift or refractive surprise can be quite traumatic to the eye.[2] We have devised an artificial IOL platform, which we have called as JBISS (Jagat and Bala Intraocular lens Supporting System) for aphakic patients. Through this technique, not only can we fix the IOL but it also facilitates IOL exchange in case of myopic shift or refractive surprise. We have successfully implanted JBISS assisted IOL in four patients [Table 1] and describe our technique in this paper.

Jagat and Bala Intraocular Lens Supporting System (JBISS)

The device was made up of hydrophilic acrylic material which comes in an universal single size of 13.5 mm, which can be expanded (up to ~15 mm) or compressed (up to ~11.00 mm) depending on the diameter of the sulcus of the patient

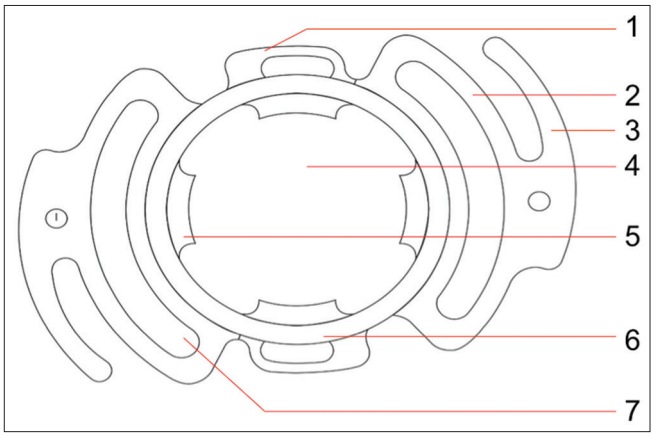

Figure 1: Shows the description and various parts of the JBISS. 1- IOL haptic holder; 2- wing of the JBISS; 3 - Haptic of the JBISS; 4 - central space of the JBISS; 5 - Optic holder; 6 – body of the JBISS; 7 – space in the wing

Department of Ophthalmology, Post Graduate Institute of Medical Education and Research, Chandigarh, [1]Medical Device, Intraocular Lens Division, Appasamy Associates (P) Ltd., Chennai, Tamil Nadu, India

Correspondence to: Dr. Jagat Ram, Department of Ophthalmology, Post Graduate Institute of Medical Education and Research, Chandigarh, India. E-mail: drjagatram@gmail.com

Indian Patent application no. 202041034562.

Received: 12-Oct-2020 Revision: 30-Jan-2021
Accepted: 13-Feb-2021 Published: 21-May-2021

Cite this article as: Balamurugan R, Ram J, Ganesh S, Kaur S, Gupta PC, Behera R. Jagat and Bala intraocular lens supporting system: An artificial platform for intraocular lens implantation in an aphakic patient with inadequate capsular support. Indian J Ophthalmol 2021;69:1618-22.

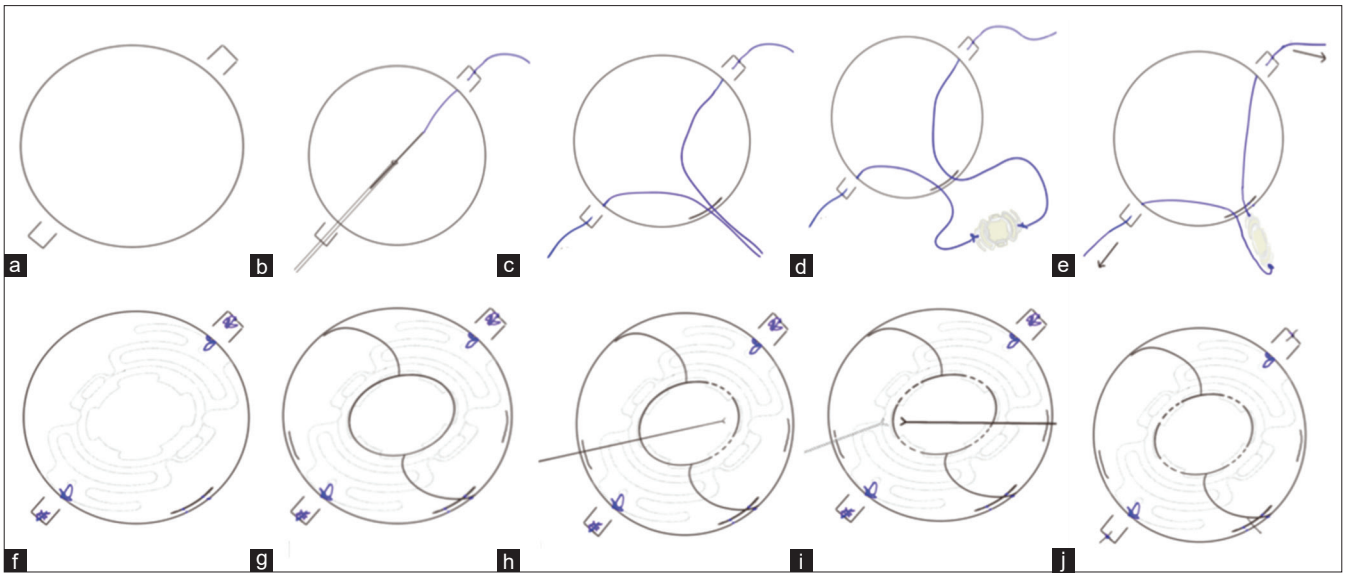

Figure 2: (a-j): Shows diagrammatic representation of the surgery(surgeon's superior view). (a) shows localized peritomy at 2'o clock and 8'o clock followed by partial thickness rectangular scleral flap after adequate cauterization of the blood vessels. (b) Insertion of long arm needle of the polypropylene suture through the scleral bed, 1.5 mm away from the limbus at 8'O clock and 26G needle through the scleral bed, 1.5 mm away from the limbus at 2'O clock and passing the long arm needle into the 26G needle inside the eye. (c) Suture was pulled out through the main incision and loop was cut with vannas scissor. (d) Both ends of the suture were tied to the JBISS at each end. (e) The JBISS with the inverted "S" orientation was folded along its vertical axis using Mcpherson and then inserted into the anterior chamber and simultaneous pulling of polypropylene sutures apart (from the sleral bed). (f) Both sutures were sutured at each scleral bed. (g) Three piece IOL was injected through main port and placed on the JBISS in a way that two haptics of the IOL were over the interholder groove. (h) Optic part of the IOL was nudged or slided below the adjacent two optic holders using Y rotator. (i) Otherside of the IOL optic was also nudged using two Y rotator (j) Main port was sutured with 10-0 nylon and scleral flap was sutured followed by closure of peritomy

and is self-adjustable with the increasing diameter of the sulcus when the eye grows with the age. The thickness is 0.3 mm which is uniform throughout the device and weighs 20 mg. Fig. 1 describes the various parts of the device. The device is divided into two parts – body and supporting parts. Body (6) has IOL haptic holder (1) (no function at present, only for future development) and optic holder (5); The supporting part consists of a pair of wing of JBISS (2) with one hole on each wing and each wing has one haptic of the JBISS (3) attached to it. The wing was provided with the space (7) which facilitates the compression and expansion of the device. The interholder groove is the small space between the two optic holders. The central space (4) is where the optic part of the three-piece IOL will be captured. The wing was angulated by 5 degree anteriorly with the central body which make the IOL and JBISS complex away from the Iris tissue. The device was crafted by Appasamy Associates (P) Ltd., Chennai. The device is applied for the Indian patent (Application no. 202041034562).

Surgical Technique

Informed consent of the patients and institutional ethical clearance were obtained. The surgical technique is divided into two parts [Video 1].

Part 1: Suturing the JBISS to the sclera with 9-0 polypropylene suture (as described by lewis *et al*.[3]).

Part 2: Injecting the foldable three-piece IOL (eg. Sensar 3-piece AR40e, Johnson and Johnson vision) inside the eye and fixing it to the JBISS implant by optic capture.

The main surgical steps involve the creation of fornix-based localized peritomy at around 2'o clock and 8'o clock followed by partial thickness rectangular scleral flaps [Figs. 2a and 3a]. One end of the 9-0 polypropylene suture (long arm) was passed through the bed of the scleral flap, 1.5 mm away from the limbus at 8'o clock and simultaneously 26G needle is passed through the bed of the scleral flap, 1.5 mm away from the limbus at 2'o clock and inserting the long arm needle into the 26G needle inside the eye [Figs. 2b and 3b]. Paracentesis was done at the limbus at 3'o clock and 9'o clock and anterior chamber maintained either by AC maintainer or viscoelastic material or both. Main clear corneal incision (approx. 4 mm) was made at 11'o clock and polypropylene suture was brought from inside to outside using Mcpherson forceps through the main corneal incision which formed the sutural loop to be cut later [Figs. 2c and 3c]. Both the cut ends of the suture were tied firmly to the two holes provided in JBISS [Fig. 2d and 3d]. The JBISS with the inverted "S" orientation was folded along its vertical axis using Mcpherson forceps and then inserted into the anterior chamber [Fig. 2e and 3e] and simultaneous pulling of polypropylene sutures apart (from the scleral bed) which prevents tangling. Now both the sutures were tied to the sclera at each scleral bed [Figs. 2f and 3f] after making proper centration and alignment of the JBISS implant inside the eye. Three-piece IOL was injected through the injector and dialed the IOL over the JBISS implant to make the haptics of the IOL align between the optic holders (i.e over the interholder groove) [Figs. 2g and 3g]. The Optic part of the IOL was nudged at its edge or slided below the two adjacent "optic holders" using Y- rotator [Figs. 2h and 3h]. Similarly, other side of the

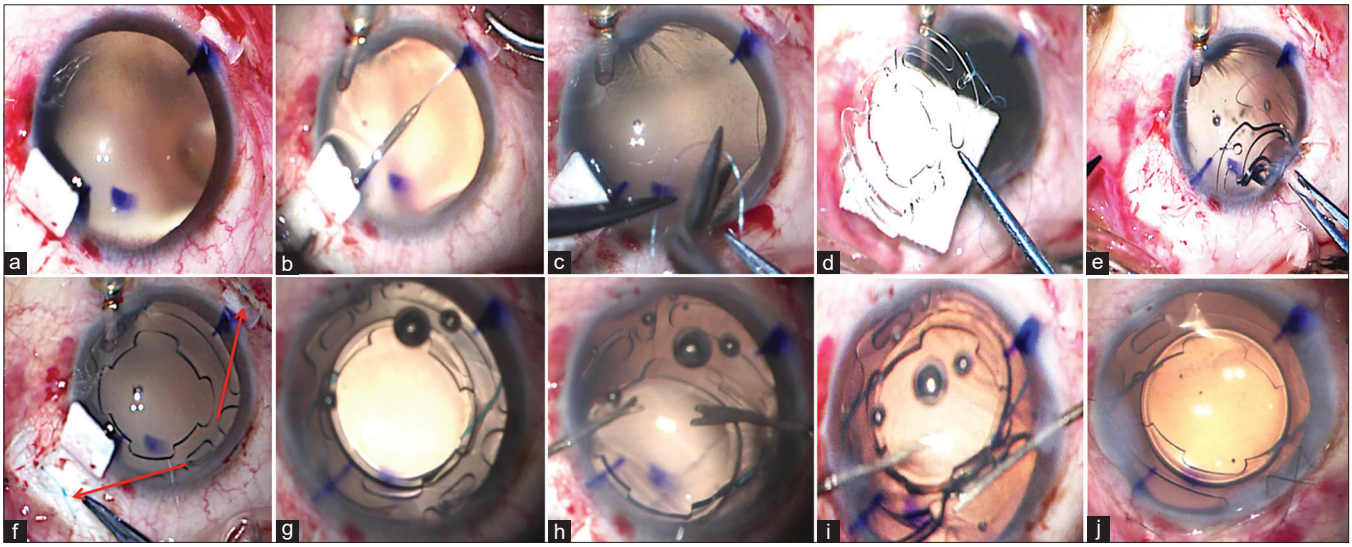

Figure 3: (a-j): Shows the important steps of the surgery (surgeon's superior view).. (a) shows localized peritomy at 2'o clock and 8'o clock followed by partial thickness rectangular scleral flap after adequate cauterization of the blood vessels. (b) Insertion of long arm needle of the polypropylene suture through the scleral bed, 1.5 mm away from the limbus at 8'O clock and 26G needle through the scleral bed, 1.5 mm away from the limbus at 2'O clock and passing the long arm needle into the 26G needle inside the eye. (c) Suture was pulled out through the main incision and loop was cut with vannas scissor. (d) Both ends of the suture were tied to the JBISS at each end. (e) The JBISS with the inverted "S" orientation was folded along its vertical axis using Mcpherson and then inserted into the anterior chamber and simultaneous pulling of polypropylene sutures apart (from the scleral bed). (f) Both sutures were sutured at each scleral bed. (g) Three piece IOL was injected through main port and placed on the JBISS in a way that two haptics of the IOL were over the interholder groove. (h) Optic part of the IOL was nudged or slided below the adjacent two optic holders using Y rotator. (i) Otherside of the IOL optic was also nudged using two Y rotators. (j) Main port was sutured with 10-0 nylon and scleral flap was sutured followed by closure of peritomy

Table 1: Summary of the four cases

Case no.	Age and sex	OD/ OS	Cause for aphakia and poor capsular support	Primary surgical intervention	Secondary surgical intervention	Pre-operative		Post-operative		Follow up duration
						BCVA	IOP	BCVA	IOP	
1	40 y/ male	OS	Trauma with stone with nucleus drop [Fig. 4a]	LE PPV + phaco-fragmentation	JBISS with IOL implantation [Fig. 4b]	6/12 (+12.50 DS/-1.50 × 160)	12 mm hg (off drugs)	6/6 (+1.00 DS/ +1.00 x 80)	12 mmhg (off drugs)	13 months
2.	19 y/ male	OS	Trauma with blunt object [Fig. 4c]	LE surgical intervention done outside during childhood	JBISS with IOL implantation [Fig. 4d]	6/12 (+8.50 DS)	21 mmhg (off drugs)	6/9 (+1.50 DS/+0.75 × 50)	18 mmhg (off drugs)	7 months
3.	66 y/ male	OD	Trauma with blunt object with subluxated cataractous lens [Fig. 4e]	RE ICCE with anterior vitrectomy	JBISS with IOL implantation [Fig. 4f]	6/60 (+9.00 DS/ + 3.00 × 100 DC)	8 mmhg (off drugs)	6/36 (+0.75 DS/-2.50 × 100)	16 mmhg (off drugs)	6 months
4.	45 y/ male	OD	Trauma with stick with subluxated lens with vitreous hemorrhage [Fig. 4g]	RE PPV + PPL	JBISS with IOL implantation [Fig. 4h]	6/18 (+11.50 DS)	21 mmhg (with brimonidine 0.2% + timolol 0.5%)	6/9(-0.50 DS/-2.00 DC × 125)	20 mmhg with (with brimonidine 0.2% + timolol 0.5%)	6 months

optic was also nudged using two Y-rotators (one Y-rotator nudges the optic of the IOL and other Y-rotator gives counter pressure to JBISS) [Figs. 2i and 3i] and hence the IOL was fixed to the JBISS by means of Optic capture. Viscoelastic material was washed out and main port, scleral flap and peritomy were sutured [Figs. 2j and 3j].

Discussion

The various causes of poor capsular support are trauma, genetic diseases (Marfan syndrome and homocystinuria), and complicated cataract surgery. The surgical options for aphakia are anterior chamber IOL (ACIOL), iris fixated IOL (IFIOL),

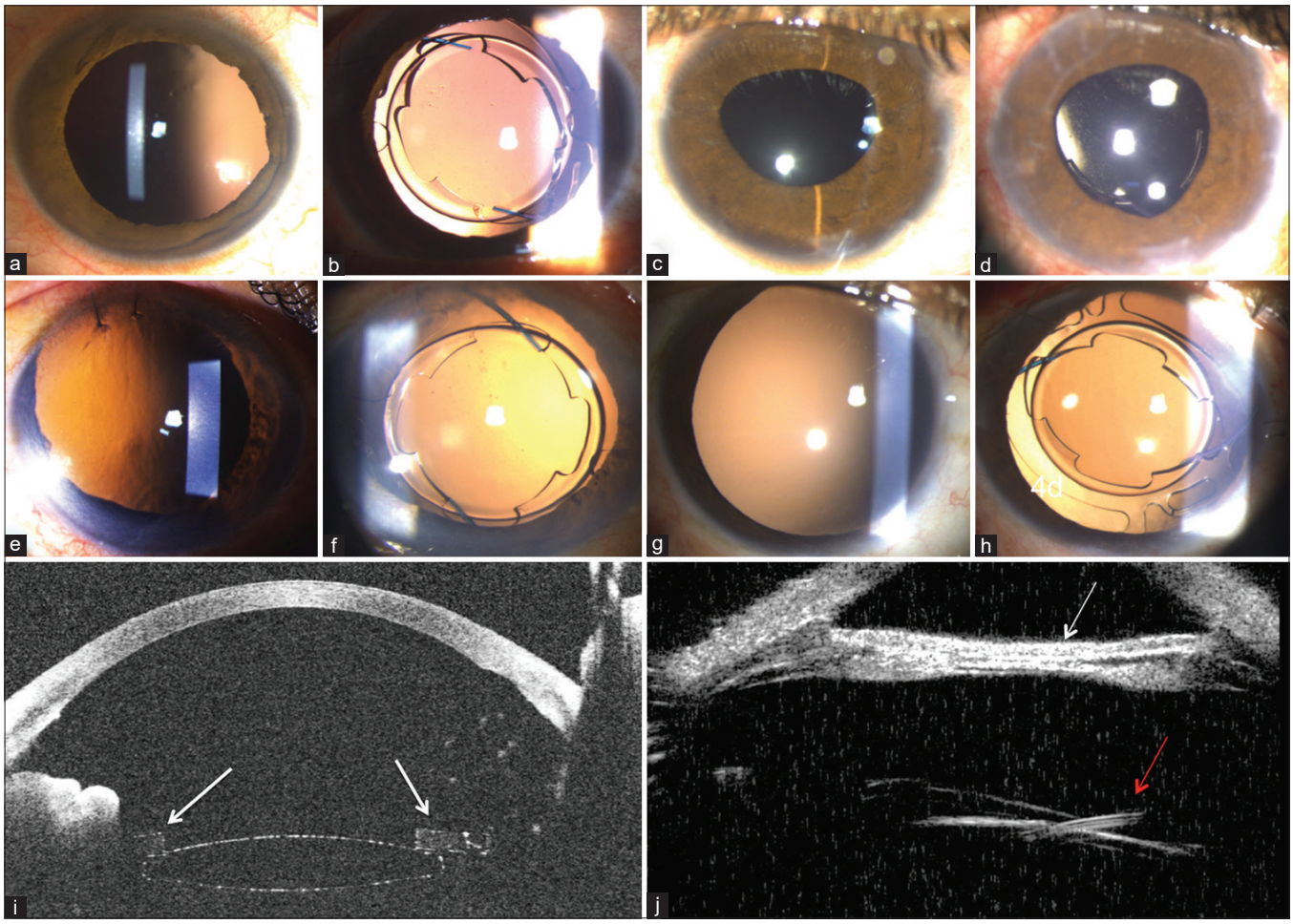

Figure 4: (a-j): a and b shows the preoperative and postoperative images of the case 1. c and d shows the preoperative and postoperative images of the case 2. e and f shows the preoperative and postoperative images of the case 3. g and h shows the preoperative and postoperative images of the case 4. i shows the postoperative Optical coherence tomography of the case 3 showing the JBISS and IOL complex which is parallel to the corneal plane with overlapping optic holder on the IOL (arrow). j shows the Ultrasound biomicroscopy which shows the clear space between the iris (white arrow) and the JBISS IOL complex (red arrow)

and Transcleral fixation of IOL (TSFIOL).[1] There are more complications associated with ACIOL and IFIOL like corneal decompensation, glaucoma, and UGH syndrome. The TSFIOL is relatively safer with respect to anterior segment but it also has its own complications like retinal detachment, IOL dislocation, IOL tilt, and decentration.[1] Scleral-Fixated IOL is of two types: 1. Sutured TSFIOL 2. Sutureless TSFIOL (Glued TSFIOL, Yamane, etc).[1] The basic technique of sutured TSFIOL described by Malbran *et al*.[4] was suturing the haptic of IOL to the sclera using 10-0 polypropylene to the sclera 2 mm away from the limbus. Lewis *et al*.[3] introduced scleral flap to cover the suture knot, thereby, reducing the suture knot exposure and suture-related endophthalmitis. Malta *et al*.[5] in his cohort study of 105 eyes who underwent combined penetrating keratoplasty and scleral sutured PCIOL, two eyes (1.9%) experienced IOL dislocation due to suture breakage at five and eight years of follow up. Mimura T, *et al*.[6] in his longitudinal observational study, at 10-year follow-up, there was no single case of suture breakage with 10-0 polypropylene. Buckley[7] experienced IOL dislocation in 4 out of 26 patients (15%) using the 10-0 polypropylene and he strongly suggested to use 9-0 polypropylene suture especially in pediatric population since 9-0 polypropylene has 60% greater tensile strength, 50% greater diameter and 125% greater cross sectional area. In our technique we used 9-0 polypropylene to suture the JBISS implant to the sclera. Agrawal *et al*.[8] used closed loop haptic foldable IOL (C-Flex 570C, Rayner intraocular lenses Ltd., UK) made up of hydrophilic acrylic material for TSFIOL which is actually meant for "in the bag implantation" and they concluded that use of hydrophilic acrylic IOL can be safely used as TSFIOL. In our novel JBISS implant, we used hydrophilic acrylic material which is a biocompatible material, safe for intraocular use with long history of use in ophthalmology clinical practice.[9] Optical coherence tomography was done which showed well centered and parallely placed IOL with respect to the cornea and with overlapping optic holder (arrow) of the JBISS [Fig. 4i]. Ultrasound biomicroscopy was done which shows the clear space between the iris (white arrow) and JBISS IOL complex (red arrow) as shown in Fig. 4j. JBISS assisted IOL implantation has the following advantages i.e., Firstly, JBISS comes in single size which can be expandable as well as compressible hence can be used universally in all age groups (minimum axial length of eye should be ≥17 mm and

corneal diameter should be ≥10 mm). Secondly, JBISS acts as an exchangeable IOL platform hence when there is a refractive surprise or high myopic shift in case of children, it facilitates IOL exchange and new IOL can be fixed with similar fashion. Thirdly, in case of extreme cases like Buphthalmos with poor capsular support, JBISS diameter can be customized according to the sulcus diameter and conventional three-piece IOL can be implanted. Fourthly, smaller corneal incision (~4.00 mm) is needed. Fifthly, surgical technique is simple (suturing JBISS to the sclera is similar to suturing the PMMA TSFIOL[3]) and fixing IOL to the JBISS by optic capture (this method of optic capture is similar to the optic capture done with anterior capsule of the natural bag in case of posterior capsular tear[10]). Sixthly, No pseudophakodonesis and hence less chance of pupillary capture.

Conclusion

JBISS implant was found to be effective in treating aphakic patients and can be safely used in the conditions with poor capsular support. Although its outcome is promising in adults, its efficacy can be further evaluated for the pediatric age group. Since it is a prototype model, further Research and Development is needed for refinement and advancement in the device.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Stem MS, Todorich B, Woodward MA, Hsu J, Wolfe JD. Scleral-fixated intraocular lenses: Past and present. J Vitreoretin Dis 2017;1:144-52.
2. Mittelviefhaus H, Mittelviefhaus K, Gerling J. Transscleral suture fixation of posterior chamber intraocular lenses in children under 3 years. Graefes Arch Clin Exp Ophthalmol 2000;238:143-8.
3. Lewis JS. Ab externo sulcus fixation. Ophthalmic Surg 1991;22):692-5.
4. Malbran ES, Malbran E Jr, Negri I. Lens guide suture for transport and fixation in secondary IOL implantation after intracapsular extraction. Int Ophthalmol 1986;9:151-60.
5. Malta JB, Banitt M, Musch DC, Sugar A, Mian SI, Soong HK. Long-term outcome of combined penetrating keratoplasty with scleral-sutured posterior chamber intraocular lens implantation. Cornea 2009;28:741-6.
6. Mimura T, Amano S, Sugiura T, Funatsu H, Yamagami S, Oshika T, *et al*. 10-year follow-up study of secondary transscleral ciliary sulcus fixated posterior chamber intraocular lenses. Am J Ophthalmol 2003;136:931-3.
7. Buckley EG. Safety of transscleral-sutured intraocular lenses in children. J AAPOS 2008;12:431-9.
8. Agrawal S, Singh V, Gupta SK, Misra N, Srivastava RM. Transscleral fixation of closed loop haptic acrylic posterior chamber intraocular lens in aphakic nonvitrectomized eyes. Indian J Ophthalmol 2015;63:649-53.
9. Li Y, Wang J, Chen Z, Tang X. Effect of hydrophobic acrylic versus hydrophilic acrylic intraocular lens on posterior capsule opacification: Meta-analysis. PLoS One 2013;8:e77864.
10. Chakrabarti A, Nazm N. Posterior capsular rent: Prevention and management. Indian J Ophthalmol 2017;65:1359-69.