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Research Article

Scleral Fixated Intraocular Lenses in the Pediatric Population: Surgical Outcomes

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Abstract

Objective: To study the indications, visual outcome and complications of scleral fixated intraocular lens (SFIOL) implantation in children.

Material and methods: Retrospective review of records of 57 eyes of children in the age group 3 - 18 years who underwent SFIOL implantation. An assessment was done of the indications for SFIOL implantation, pre and postoperative best corrected visual acuity (BCVA) and postoperative complications.

Results: 57 eyes of 46 children were included. Mean age was 9.65 ± 4.33 years (3 - 18 years) with mean follow up period of 30.16 ± 29.22 months (2 - 96 months). SFIOL implantation was done as a primary or a secondary procedure. The mean best corrected visual acuity improved from 0.90 ± 0.87 logMAR preoperatively to 0.47 ± 0.52 logMAR postoperatively at the final follow-up. Early complications such as vitreous hemorrhage (VH), retinal detachment (RD), optic capture, peripheral anterior synechiae (PAS) and intraocular lens (IOL) decentration were noted. Late complications included suture erosion, IOL decentration, band shaped keratopathy (BSK) formation, epiretinal membrane (ERM) formation, vitritis and ocular hypotony.

Conclusion: SFIOL provides an effective and safe method of visual rehabilitation in children with aphakia without capsular support. A prolonged follow-up is advised for the patients in order to detect and treat early and late complications of SFIOL.

Keywords: *Scleral Fixated Intraocular Lenses (SFIOL); Intraocular Lens (IOL); Retinal Detachment (RD); Peripheral Anterior Synechiae (PAS)*

Introduction

Visual rehabilitation of an aphakic child is a major challenge for an ophthalmologist [1]. There is an increased risk of amblyopia if these eyes are left untreated. This mandates an early optical correction by either a non-surgical approach or a surgical intervention. Non-surgical correction is done by spectacles or contact lenses. Spectacles cannot be given in children with unilateral aphakia due to diplopia and aniseikonia, which impairs binocularity. Contact lenses overcome this limitation but are associated with other drawbacks such as difficult lens care regimes, corneal irritation, abrasion and infection, leading to non-compliance [1-3].

Surgical correction of aphakia can be done by intraocular lens implantation in the anterior or posterior chamber. The various options include anterior chamber intraocular lens (ACIOL), posterior chamber intraocular lens (PCIOL) in the sulcus or the capsular bag, iris claw lenses, Glued IOL and SFIOL [4-9]. In the event of a posterior capsule tear during cataract extraction or trauma, IOL placement can be done in the sulcus if the capsular rim is available or in the bag if the tear is small. If the posterior capsule tear is large or the capsular rim is not available, SFIOL or ACIOL may be implanted. Placing a SFIOL instead of an ACIOL has certain advantages such as less corneal endothelial damage and less aniseikonia in the contralateral eye [10-11].

Several studies have shown SFIOL implantation as a safe and effective procedure in pediatric age group [12-18]. We did a retrospective analysis of the surgical outcomes of SFIOL in our patients.

Material and Methods

A retrospective analysis of the medical records was done. Fifty seven eyes of 46 children aged 3 to 18 years who underwent SFIOL implantation from January 2007 to July 2017 at a tertiary eye care institute in North India were included. The study was reviewed and approved by the institutional review board and conducted in compliance with declaration of Helsinki.

SFIOL implantation was either done as a primary or secondary procedure. A primary procedure was defined when lens aspiration and SFIOL were done in the same sitting and secondary SFIOL implantation when performed later as a staged procedure.

Indications of primary SFIOL were lens subluxation of grade 3 and grade 4 according to the lens subluxation grading system [19], or lens dislocation in the vitreous cavity and a secondary SFIOL implantation was done in patients having aphakia secondary to trauma, traumatic cataract, previous history of lensectomy on presentation and in patients with congenital cataract who did not have adequate capsular support post surgery (Table 1). Traumatic cataract was seen in 25 eyes with 5 of these eyes showing subluxation, 20 eyes had a subluxated lens, 7 eyes showed a lens dislocation and 5 eyes had a congenital cataract.

Indications	Number of eyes
Subluxated lens	25
Traumatic Cataract	25
Dislocated lens	7
Congenital Cataract	5

Table 1: *Indication for SFIOL in the study patients.*

The preoperative BCVA, axial length, keratometry readings, measurement of intraocular pressure (IOP), slit-lamp examination and fundus findings were recorded. History of any previous ocular surgery was taken. All patients underwent a complete systemic evaluation by an internist to rule out other comorbidities.

The SFIOL power was calculated using the SRK II formula using A scan biometry (Alcon Ocuscan RXP). In children where the preoperative biometry was not possible, intraoperative A-scan biometry and hand held auto keratometry (Nidek KM 500) was done under general anaesthesia. The postoperative refraction was targeted for emmetropia or under correction according to the age of the child [20]. All surgeries were performed by a single vitreoretinal surgeon. Postoperatively all the children were evaluated by a pediatric ophthalmologist and prescribed occlusion therapy whenever required. The postoperative data recorded included BCVA, refraction and the final glass prescription at two months follow up. Ocular examination findings at each follow up visit including anterior segment findings, centration of the IOL, fundus examination and any complications were noted.

In all but 1 eye which had history of vitrectomy and lens removal, a pars plana vitrectomy was performed with examination of the retinal periphery to rule out peripheral retinal lesions including retinal breaks or dialysis. The SFIOL was a polymethylmethacrylate (PMMA) lens of 6.5 mm diameter. Two sclera flaps were made at 2 and 8 o'clock positions and an ab-externo technique was used to introduce the 10-0 prolene suture on straight needles 1.5 mm posterior to the limbus under each scleral flap and brought out through the limbal incision using the rail road technique. The suture was then looped to the eyelet on the SFIOL haptic and retrieved back under the scleral flap on the same side. The same procedure was then repeated on the other side however the passing of the suture through the eyelet of the IOL was upside down on one side and reverse on the other side to avoid the tilting of the lens and postoperative astigmatism. The SFIOL was then slipped in through the limbal section into the ciliary sulcus and the prolene sutures were then tightened under the sclera flaps after the limbal section was sutured with interrupted 10-0 monofilament nylon sutures. The scleral flaps were then sutured to avoid exposure of the prolene sutures. A four point fixation of the SFIOL was thus achieved. Conjunctiva was closed using 7-0 vicryl.

Results

57 eyes of 46 children were included in the study. The mean age at presentation was 9.65 ± 4.33 years (3-18 years). The study included 35 males and 11 females who had a mean follow up of 30.16 ± 29.22 months (2 - 96 months). Primary SFIOL was performed in 16 eyes and secondary SFIOL in 41 eyes (Table 2).

	Primary Procedure	Secondary Procedure
Number of eyes	16	41
Number of patients	10	36
Males	6	29
Females	4	7
Mean age at presentation	8.62 ± 4.70	9.87 ± 4.29
Etiology of aphakia		
Trauma	0	25
Subluxated lens	10	10
Dislocated lens	6	1
Congenital cataract	0	5

Table 2: *Demographic profile of 46 patients in whom SFIOL was performed.*

Ten of the 16 eyes with primary SFIOL, 10 eyes had a subluxated lens at presentation for which a lensectomy with SFIOL was done. Two of these patients were diagnosed to have Marfan's Syndrome.

Out of the 41 eyes with secondary SFIOL, 25 eyes (60.98%) had history of trauma. 10 (24.40%) eyes presented with aphakia secondary to lensectomy for subluxation, 5 eyes (12.20%) had history of lensectomy for congenital cataract and 1 eye had history of vitrectomy and lens removal secondary to dislocated lens.

In the 25 eyes with history of trauma, 10 eyes had history of corneal tear repair along with lens aspiration with 3 eyes having a corneal scar involving the visual axis, 3 eyes had history of lensectomy with IOFB removal, 8 eyes had undergone retinal detachment surgery along with lensectomy, 3 eyes presented secondary to iridodialysis repair and lens aspiration and 1 eye presented with aphakia secondary to vitrectomy and lensectomy for VH.

The mean BCVA improved from 0.9 ± 0.87 logMAR preoperatively to 0.47 ± 0.52 logMAR postoperatively. In children who underwent SFIOL secondary to trauma BCVA improved from 0.95 ± 0.89 preoperatively to 0.68 ± 0.67 postoperatively ($p = 0.31$). In children with no history of trauma, BCVA improved from 0.86 ± 0.87 preoperatively to 0.36 ± 0.35 postoperatively ($p = 0.001$). One way annova was conducted to analyze the vision improvement between pre-operative vision, BCVA at 2 months and at final follow-up. In the primary procedure, post hoc analysis using bonferroni method reveals that there was significant improvement of vision from the preoperative BCVA to the BCVA at 2 months ($p = 0.013$) and from preoperative BCVA to the BCVA at final follow-up ($p = 0.012$). The visual improvement from 2 months to final follow-up was not statistically significant. In the patients undergoing secondary procedure the improvement in BCVA was not statistically significant.

Mean BCVA	Preoperative	2 months	Last follow-up
Primary Procedure	1.21 ± 1.04	0.47 ± 0.44 ($p = 0.013$)	0.46 ± 0.43 ($p = 0.012$)
Secondary Procedure	0.78 ± 0.77	0.48 ± 0.43 ($p = 0.22$)	0.47 ± 0.55 ($p = 0.60$)

Table 3: *Best corrected visual acuity (BCVA) preoperative, 2 months postoperative and at final follow-up.*

Complications were defined as early (less than 4 weeks) and late (more than 4 weeks).

Early complications noted were optic capture in 2 eyes, peripheral anterior synechiae formation in 1 eye and IOL decentration in 2 eyes. Vitreous hemorrhage (VH) was noted in 1 eye on the first postoperative day and at 3 weeks the eye developed a retinal detachment (RD). Late complications noted were formation of band shaped keratopathy (BSK) in 2 eyes at 3 months, one of which underwent ethylenediamine tetra-acetic acid (EDTA) chelation. Both these eyes had history of previous RD surgery and silicon oil removal. Suture erosion was noted in 1 eye at 6 years follow-up and the IOL was found to be tilted for which the patient underwent IOL repositioning. ERM developed in 2 eye at 2 months and 3 months respectively. One eye with a history of RD surgery was seen to develop shallow anterior chamber and recurrent inflammation at 6 years post SFIOL implantation. On ultrasound biomicroscopy the SFIOL haptic was seen to rub the ciliary processes. The patient was treated with oral and topical corticosteroids, however he finally developed BSK with severe hypotony for which silicon oil injection had to be performed. At the final follow up SFIOL was found to be decentered in 2 eyes, requiring no surgical intervention as it was within the pupillary area (Table 4).

	Primary Procedure	Secondary Procedure
Median follow-up (in months)	21	23
Range	2 - 96	2 - 87
Early Complications		
Optic Capture	2	
VH		1
RD		1
PAS		1
IOL decentration	2	
Late Complications		
BSK		2
Suture erosion		1
ERM		2
Vitritis		1
Ocular hypotony		1
IOL decentration		2

Table 4: *Early and late complications seen with SFIOL implantation.*

Discussion

The correction of aphakia in a child can be very challenging for an ophthalmologist. The difficulties are due to the aphakia often being unilateral secondary to trauma leading to aniseikonia and anisometropia with aphakic glasses. Contact lenses are associated with problems like frequent loss of contact lenses by children, irritation in the eyes, infection and vascularization [1-3], making children non-compliant with contact lenses. Unlike an adult there is an increased risk of the eye becoming amblyopic if not corrected on time.

With consistent improvement in IOL designs and evolving surgical techniques, secondary IOL implantation provides us with an excellent option of visual rehabilitation and long term maintenance of a clear visual axis in the pediatric age group [3-5].

The various IOL options for children with inadequate capsular support include iris claw lens, glued IOL, ACIOL, and SFIOL [4-9].

Anterior chamber intraocular lenses are best avoided in children due to the increased risk of corneal endothelial damage and corneal decompensation, iris sphincter erosion, pupillary ectopia and secondary glaucoma [2-5,9,21,22].

Fixation of posterior chamber lenses with the help of transscleral sutures allows a safe alternative for visual rehabilitation in aphakic children [9]. Also, as opposed to ACIOL, SFIOL placement is more suitable in eyes with peripheral anterior synechiae or large sector iridectomies [23].

All the children underwent strict amblyopia therapy after SFIOL implantation which may play a vital role in the final BCVA improvement.

There are certain disadvantages of SFIOL such as a more complex technique of surgery and longer surgical time. Erosion of the scleral fixation sutures may lead to endophthalmitis [24], as the suture provides a permanent entry track for microorganisms inside the eye and suture breakage may cause tilting or dislocation of the lens [25], suprachoroidal hemorrhage [26] and retinal detachment [27].

In our series we did pars plana vitrectomy in all but 1 eye with meticulous removal of all the vitreous from the passage of the suture needle thereby avoiding any traction at the vitreous base. This helped in less disturbance of the vitreous during passage of the needle, hence decreasing complications such as retinal breaks, dialysis or retinal detachment.

We encountered suture erosion in only one eye with no endophthalmitis and this was probably attributed to the proper burial of the sutures under the scleral flaps and leaving the cut ends of the prolene suture long such that it follows the contour of the eyeball and does not stand vertically eroding the conjunctiva. This decreased the chances of suture erosion, suture exposure, breakage and late endophthalmitis [13,21,24,28,29]. Also, we used 10-0 prolene suture to anchor the SFIOL in all children. Prolene sutures are considered to have a longer survival but they do biodegrade and eventually lead to IOL dislocation [14,30-32].

Our series has a mean follow up 30.16 ± 29.22 months with 39 eyes having a follow up of more than 1 year and 25 eyes having a follow up of more than 2 years. Optical correction with SFIOL in paediatric patients has minimal risk of complications if certain precautions are taken such as proper vitrectomy and burial of the suture knots under the scleral flaps.

Limitation

Our study is limited by its retrospective nature and a randomized comparative study with larger sample size is required to further add to the understanding of SFIOL outcomes in the pediatric population. Only 25 eyes (43.8%) had a follow up of more than 2 years. A longer follow up period would be required to understand late complications such as suture erosion and IOL dislocation.

Conclusion

Aphakia in children is a challenging situation and warrants early correction as it poses a threat for these patients to develop amblyopia. A surgical correction offers better ambulation and recovery than correction with glasses or contact lenses and SFIOL implantation offers a safe and effective method for treatment of aphakic children. Children undergoing SFIOL implantation should be given amblyopia therapy wherever necessary.

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