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CLINICAL STUDY

Comparison of epilenticular IOL implantation *vs* technique of anterior and primary posterior capsulorhexis with anterior vitrectomy in paediatric cataract surgery

A Rastogi, S Monga, C Khurana and K Anand

Abstract

Purpose **To compare the functional outcome of epilenticular intraocular lens (IOL) implantation *vs* the technique of anterior continuous curvilinear capsulorhexis (ACCC), posterior continuous curvilinear capsulorhexis (PCCC) with vitrectomy and in-the-bag IOL implantation in paediatric cataract surgery.**

Methods **Forty eyes of 33 children with developmental or traumatic cataract, whose mean age was 2–12 years, were randomly divided into two groups A and B. Group A patients underwent epilenticular IOL implantation while in group B patients, ACCC, PCCC with anterior vitrectomy with in-the-bag IOL implantation was performed. Equal number of eyes (10 each) with developmental cataracts (subgroups A1 and B1) and traumatic cataracts (subgroups A2 and B2) were allotted to both the groups. Postoperative visual acuity, opacification of the visual axis, and possible complications were observed and analysed.**

Results **Four eyes in subgroup B2 had fibrous or ruptured capsules, and were managed by epilenticular IOL implantation technique. One eye in subgroup B2 developed central posterior capsular opacification and hence required a secondary capsulotomy. All cases in group A maintained a clear visual axis at the last follow-up. Minimal postoperative inflammation was noticed in all groups, which subsided with anti-inflammatory medication. At the last follow-up, all eyes in group A gained visual acuity $\geq$6/18. Whereas in group B, visual acuity $\geq$6/18 was obtained in 85.7% cases with the epilenticular IOL implantation technique and in 83.3% cases with ACCC and PCCC with anterior vitrectomy technique.**

Conclusion **Epilenticular IOL implantation offers a safe and effective alternative for management of paediatric cataract. In selected cases of traumatic cataract, it is the preferred treatment modality.**

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Introduction

Paediatric cataract surgery has come a long way towards achieving the desirable goals of restoration of clear visual axis without further intervention and minimal operative and postoperative complications.[1]

Refined surgical techniques, improved intraocular lens (IOL) materials, and better viscoelastics have made this a reality. However, visual axis opacification (VAO) continues to be the major hurdle in the path of successful visual rehabilitation of a child with cataract.

Primary posterior capsulotomy, with and without anterior vitrectomy, has been tried to

Pediatric Ophthalmology Service, Guru Nanak Eye Centre, Maulana Azad Medical College, New Delhi, India

Correspondence:
A Rastogi,
B-18,
Friends Colony West,
New Delhi, India
Tel: +91 011 26312859/ +91 981 8340924;
Fax: +91 011 26312859.
E-mail: dranjurastogi@yahoo.co.in

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reduce the incidence or posterior capsular opacification (PCO), with variable results.[2–4] Gimbel *et al*[5,6] suggested capturing of posterior chamber IOL through the posterior capsulorhexis as an effective method to counteract PCO. Anterior continuous curvilinear capsulorhexis (ACCC) with posterior continuous curvilinear capsulorhexis (PCCC) with vitrectomy and in-the-bag IOL implantation ensures a clear visual axis, and is the ideal technique for management of paediatric cataract. However, it is technically demanding and difficult to perform in some cases of traumatic cataracts, which are membranous or partially absorbed or where the posterior capsule is ruptured. In these situations, the technique of epilenticular IOL implantation with pars plana lensectomy and vitrectomy may offer a viable alternative with comparable functional results.[7–9]

Epilenticular IOL implantation is easier to perform, provides a stable, well-centred IOL, and most importantly, maintains a clear visual axis.[9] As the IOL is placed in the ciliary sulcus, its insertion is independent of the posterior capsular status. Although not as ideal as in-the-bag IOL implantation for any age group, this technique offers an excellent functional outcome.[9] It ensures IOL insertion in cases where the posterior capsular status is unknown. Thick and fibrous capsules often associated with traumatic cataracts can be easily tackled by this route. In these cases, it is not always possible to perform a successful anterior and posterior capsulorhexis with stable IOL implantation.

We conducted a prospective randomized study to compare epilenticular IOL implantation with ACCC, PCCC with vitrectomy, and in-the-bag IOL implantation in cases of developmental and traumatic cataracts in children.

Materials and methods

Forty eyes of 33 children in the age group of 2–12 years with congenital/developmental or traumatic cataracts were included in this prospective randomized study conducted at Guru Nanak Eye Center, from December 2001 to July 2003. Randomization was carried out by Epistat software. The average follow-up ranged between 8 and 17 months (average 14.2 months). The study protocol was reviewed and approved by the institutional Review Board. Children were randomly allotted to two groups A and B. In group A, the patients were posted for epilenticular IOL implantation technique (20 eyes). In group B, the patients were posted for anterior and posterior capsulorhexis with anterior vitrectomy with in-the-bag IOL implantation (20 eyes). The patients were consecutively posted for surgery by the above two techniques. Equal number of eyes (10 each) with developmental cataract (A1and B1 groups) and traumatic cataract (A2 and B2 groups) were allotted to both the groups to prevent any selection bias or difference in postoperative outcome due to trauma. Eyes with complicated cataracts or any other gross ocular pathology (microphthalmos, coloboma, glaucoma, uveal inflammation, or corneal opacities causing significant corneal astigmatism) were not included in the study. Traumatic cataracts with retinal pathology, intraocular foreign body, active inflammation, associated glaucoma, or significant corneal opacity were excluded from the study. Children with any severe systemic illness likely to affect the results of the study were also excluded. A written informed consent was taken from the parents/guardians of each patient. A detailed history regarding the ocular as well as systemic complaints, and nature of injury was noted for each patient. The ophthalmic examination included recording of the visual acuity (using picture charts, illiterate E charts, or Snellen's charts depending on the age of the child), cycloplegic refraction, intraocular pressure measurement, and slit-lamp examination. Fundus examination was carried out by direct or indirect ophthalmoscopy wherever possible. Ultrasound B scan was performed for posterior segment evaluation and to exclude the presence of any intraocular foreign body. Relevant laboratory investigations were performed. TORCH titers were evaluated in cases of developmental cataract. Keratometry was performed with a Bausch and Lomb Keratometer (Bausch and Lomb Surgical, Inc. St Louis, MO, USA). Axial length was measured using ultrasound biometry. IOL power was calculated using SRK II regression formula. Dahan's guidelines were used for IOL power selection.[10] For children between 2 and 8 years, IOL power was undercorrected by 10%. The emmetropic power was prescribed above this age making adequate adjustments to avoid gross anisometropia.

All surgeries were performed under general anesthesia by a single operating surgeon (AR). The pupil was dilated preoperatively, with tropicamide 1% and phenlyephrine 5% eye drops along with flurbiprofen 0.03%.

Surgical technique

In group A cases, epilenticular IOL implantation was carried out as follows: A fornix-based conjunctival flap was made, followed by cautery of episcleral bleeders. Two partial thickness sclerotomies were made at 10 and 2 o'clock position, 2.5-3 mm from the limbus. A 6.5 mm scleral tunnel incision was made at 12 o'clock with the external incision 1 mm from the limbus. A posterior chamber IOL (PMMA 6.5 × 13 mm, 812A Pharmacia) was implanted over the cataractous lens. The incision was closed with 10–0 nylon sutures with a temporary knot. Full thickness sclerotomies were then made with a disposable V-lance knife. A pars plana lensectomy and vitrectomy was performed using an automated vitrectomy cutter and a 20-gauge infusion cannula. The Microsurgical vitrectomy 2000 V was used for this purpose with machine parameters being: vacuum 250–300 mmHg and cut rate of 350–400 cuts/min. A 360-degree peripheral rim of anterior and posterior capsules and cortex were left behind. The scleral tunnel knot was made permanent and the sclerotomies sutured. Subconjunctival injection of 20 mg gentamicin sulphate and 2 mg of dexamethasone sodium phosphate was administered. A sub-tenon's injection of 20 mg of triamcinolone acetate was given in the inferior fornix.

In group B cases ACCC, PCCC with vitrectomy, and in-the-bag IOL implantation was carried out. A fornix based conjunctival flap was made. A scleral tunnel was made and the anterior chamber reformed using sodium hyaluronate 1.4%. Anterior capsulorhexis was performed using capsulorhexis (Kraff Utrata) forceps after initial puncture with a 26-gauge needle. This was followed by hydro dissection and a thorough cortical clean up. Sodium hyaluronate was injected into the bag and a puncture was made in the posterior capsule. Healon GV was injected below the capsule to push back the vitreous. A posterior capsulorhexis 3.5–4 mm in size was performed using the capsulorhexis forceps. A 2-port vitrectomy was carried out from the anterior route to remove the anterior 2 mm of the vitreous. The tunnel incision was enlarged to 6 mm, the bag was inflated with Healon GV and in–the-bag implantation of the posterior chamber IOL was carried out (PMMA IOL12 $\times$ 6 mm, 811C Pharmacia). The section was sutured with 10-0 nylon. A subconjunctival injection of 20 mg gentamicin sulphate and 2 mg of dexamethasone sodium phosphate was administered. A sub-tenon's injection of 20 mg of triamcinolone acetate was given in the inferior fornix.

The postoperative treatment regimen consisted of topical prednisolone acetate 1% and ciprofloxacin 0.3% drops, administered 2 h on the first postoperative day and gradually tapered off over the next 12 weeks. Cycloplegic eye drops were given twice daily in the first week to keep the pupil mobile.

Postoperative evaluation was performed after 24 h, 1 week, 1, 3, 6, and 12 months after surgery by an independent observer. Care was taken to ensure more frequent follow-ups for managing the accompanying ambylopia in our patients. At each visit, visual acuity was assessed. Slit-lamp examination was carried out to assess anterior segment reaction (cells and flare), posterior synechiae, lens deposits, IOL centration, and opacification of the visual axis.

Lens deposits and VAO were graded as described in literature.[11,12] Eyes showing opacification of the visual axis, leading to reduction in BCVA, underwent Nd:YAG laser or surgical posterior capsulotomy. Refraction was performed at 1 month and repeated after 3 months, 6 months, and 1 year after surgery. Appropriate spectacles were prescribed. Prompt and aggressive amblyopia therapy was administered wherever required in the form of occlusion of the normal eye according to standard regime.[13,14] Cases with total or unilateral cataract were started ambylopia therapy on the first postoperative day itself. The patients on ambylopia therapy were followed up more frequently and strict compliance was ensured to promote early visual rehabilitation. Fundus evaluation was performed at each visit. The follow-up period ranged from 8 months to 17 months. Statistical analysis was carried out using the Students' *t*-test.

Results

Preoperative evaluation

Forty eyes of 33 children with developmental or traumatic cataract were included in the study. The mean age was 7.02 years (range 3–12 years). The cases were followed for a mean period of 8–17 months. The most common type of cataract morphology seen in children with congenital/developmental cataract was lamellar (65%) followed by total cataract (20%) (Table 1). In children with traumatic cataract, the most common mode of injury was wooden stick (35%) and stone (25%), together accounting for more than half the cases. In the remaining children, trauma was caused due to firecrackers and bow and arrow (commonly used while playing in India, especially during festivals). Other agents implicated were pencils and wire. These eyes had associated ocular injuries like corneal opacities (secondary to healed corneal laceration), hyphema, iris tears, and lid injuries. Appropriate management was done to take care of these injuries, before the patient could be posted for surgery for traumatic cataract. The time interval between the injury and the child presenting to the hospital with cataract varied between 1 and 8 months (average 3.9 months).

The preoperative vision varied from light perception with accurate projection to 6/24 in both the groups. Children with traumatic cataract had a lower preoperative vision. The decimal conversion of vision was carried out to aid in statistical analysis. The average pre-op vision was 0.087 ± 0.107 in group A and 0.085 ± 0.086 in group B. The difference between the two values was not statistically significant (P-value $= 0.852$).

Table 1 Patient demographics

Parameter	*Group A1*	*Group A2*	*Group B1*	*Group B2*
Mean age (in years)	7.1±2.84	7.1±2.12	6.6±2.69	7.3±2.05
Gender M/F	5/5	11/3	6/4	4/2
Eye R/L	6/4	8/6	4/6	4/2
Morphology of cataract developmental	$N^3=10$		$N^3=10$	
Lamellar	6		7	
Nuclear	1		1	
Total	2		2	
Posterior subcapsular	1			
Traumatic	—	$N^3=14$	—	$N^3=06$
Intumescent lens		2		1
Calcified capsule		2		0
Partially absorbed lens		4		0
Lens matter in AC		2		1
Others		4		4

M/F = male/female; R/L = right/left; AC = anterior chamber; *N* = total number of cases in subgroup.

Peroperative complications

In four eyes with traumatic cataract scheduled for anterior and posterior capsulorhexis with anterior vitrectomy with in-the-bag IOL implantation (group B2), it was not possible to complete the surgery. These had to be converted to the epilenticular technique (group A2) to ensure IOL implantation and a clear visual axis. In two of these cases, there was a calcified capsule and a partially absorbed cataract with thick and fibrotic capsule, which resisted completion of an anterior capsulorhexis. Furthermore, intercapsular adhesions prevented in-the-bag IOL implantation. In two other cases, large, pre-existing posterior capsular rents were noted, which led to vitreous prolapse. After aspirating as much lens matter as was possible, the IOL was placed over the anterior rhexis and the scleral tunnel was sutured. Pars plana side ports were made and lensectomy–vitrectomy was completed. Thus, the number of cases in group A2, increased to 14 and the number of cases in group B2, decreased to 6. There was no incidence of iris prolapse, vitreous upthrust or scleral collapse in any patient in both the groups.

In group A2, lens droppings into the vitreous occurred in one eye with traumatic cataract while trying to remove the peripheral cortical matter. This child was given a short course of systemic steroids and did not develop significant vitritis. In one eye with anterior capsular rupture present preoperatively, lens matter in the anterior chamber was aspirated before IOL implantation. No other intraoperative complications were noted. It was possible to clear the visual axis in all eyes in this group with pars plana lensectomy and vitrectomy.
Safe and stable IOL implantation was possible in all eyes.

In two eyes with developmental cataract in group B1, the posterior rhexis became eccentric while removing a posterior subcapsular plaque. However, IOL implantation in the bag was carried out safely and the IOL remained stable during follow-up. In the remaining eight eyes with developmental cataract, the surgery was uneventful.

Postoperative features

There was no case of wound leak or pupillary capture in any eye. Uveitis in the form of anterior chamber reaction was observed in 58.3% eyes in group A and 56.3% eyes in group B, at the end of 1 week. By 1 month, 87.5% eyes in group A were free of any anterior chamber reaction while all eyes in group B were free of any reaction. By 3 months, no eye in either group had any uveitis. The difference between the two groups was not statistically significant (P-value = 0.262). One eye with traumatic cataract in group A2 developed fibrin reaction, which resolved with increase in the frequency of administration of topical steroids (prednisolone acetate 1%) and mydriatic (cyclopentolate 1%). IOL deposits were noted and graded at each follow-up visit.[12] 66.6% eyes in group A and 37.5% eyes in group B had IOL deposits after 1 week of follow-up. This reduced to 20.8% in group A and 6.3% in group B by 3 months (P-value = 0.373). At the last follow-up, 16.6% eyes in the epilenticular group had few deposits while 6.3% in the ACCC, PCCC group had some IOL deposits.

All eyes demonstrated a significant improvement in visual acuity from the first postoperative day. At the end of the first postoperative week, 3(30%) eyes in group A1 had vision ≥6/18, compared to 4 (40%) eyes in group

B1.While, in case of traumatic cataracts, a similar visual gain was obtained in 4 (28.5%) cases in group A2 and one (16.6%) case of group B2. By 3 months, 90% eyes in groups A1 and B1 had gained vision ≥6/18. Whereas in traumatic cataract cases, at 3-month follow-up, vision improved to ≥6/18 in 78.5% cases in group A2 and 83.2% cases in group B2. The average decimal visual acuity in group A1 at the last follow-up was 0.581 and in group B1 was 0.663. No significant difference was noted in the mean visual gain between the two groups (Students' t-test value = 0.280; P-value > 0.1). The average decimal visual acuity was comparatively lesser in the traumatic cataract group, being 0.521 and 0.515, respectively, for groups A2 and B2. No significant difference was noted in the mean visual gain between the two groups (Students' t-test value = 0.002; P-value > 0.1). The visual acuity in one eye in group B2 did not improve despite a clear visual axis. This was due to a post-traumatic macular scar, which was not detected preoperatively. A larger number of eyes in group B (ACCC, PCCC group) gained a visual acuity of 6/9 or better. The details are given in Table 2.

One eye with a traumatic cataract in group B had closure of the posterior rhexis and VAO (grade 2) at 8 months of follow-up. Nd:YAG laser capsulotomy was performed for this patient to clear the visual axis. All other eyes maintained a clear visual axis till the last follow-up.

One eye had macular edema in group A (Table 3). The child was given a short course of systemic steroids. The oedema settled after 2 weeks and the patient had good visual gain. No case of glaucoma or retinal detachment was noted in any eye in either group during the follow-up period. Geometric IOL decentration was also noted in one eye in group A after full pupillary dilatation. However, it was not evident in the normal position of the pupil and did not cause any visual problem.

Discussion

The major challenges for successful paediatric cataract surgery are a rapid postoperative inflammatory response, secondary membrane formation in the visual axis and the potential for developing severe vision deprivation amblyopia.

Several surgical techniques have been tried to prevent the secondary opacification of the visual axis after PCCC.[2,3,5] These include combining it with anterior vitrectomy or optic capture of the IOL.[3,5] Vasavada *et al*[2] emphasized the need for anterior vitrectomy along with PCCC. Fenton and O'Keefe[15] reported that 15.6% of children with PCCC and no vitrectomy required a

Table 2 Postoperative visual outcome

Visual acuity	*1 week FU*				*3 months FU*				*Last FU*			
	Grp A1	*Grp A2*	*Grp B1*	*Grp B2*	*Grp A1*	*Grp A2*	*Grp B1*	*Grp B2*	*Grp A1*	*Grp A2*	*Grp B1*	*Grp B2*
≤6/60	2 (20%)	3 (21.4%)	1 (10%)	1 (16.6%)	0	1 (7.1%)	0	1 (10%)	0	0	0	1 (16.6%)
6/36–6/24	5 (50%)	7 (50%)	5 (50%)	4 (66.6%)	1 (10%)	2 (14.2%)	1 (10%)	0	0	2 (14.2%)	0	0
6/18–6/12	3 (30%)	4 (28.5%)	4 (40%)	1 (16.6%)	6 (60%)	8 (57.1%)	6 (60%)	4 (66.6%)	6 (60%)	7 (50%)	5 (50%)	3 (50%)
6/9–6/6	0	0	0	0	3 (30%)	3 (21.4%)	3 (30%)	1 (16.6%)	4 (40%)	5 (35.7%)	5 (50%)	2 (33.3%)

FU = Follow-up; Grp = Group.

Table 3 Comparative summary of complications

Complication	*Group A (epilenticular IOL implantation)*	*Group B (ACCC with PCCC with anterior vitrectomy)*
VAO	Nil	1 case in subgroup B2 (required secondary capsulotomy)
Uveitis	3 eyes (12.5%)at 1 mo FU; resolved in all eyes at 3 mo FU	Resolved in all eyes at 1 mo FU
IOL deposits	4 eyes at last FU (16.6%)	1 eye at last FU (6.3%)
IOL decentration	1 (mild)	Nil
Macular oedema	1 (resolved with therapy)	Nil
IOL dislocation	Nil	Nil
Retinal detachment	Nil	Nil
Lens droppings into the vitreous cavity	1 case in group A 2 (spontaneous absorption)	

VAO = visual axis opacification; mo = month; FU = follow-up; IOL = intraocular lens.

Nd:YAG capsulotomy for PCO. However, vitrectomy has been a feared procedure in paediatric eyes due to its own inherent risks.[16,17]

Another technique for maintaining a long-term clear visual axis is epilenticular IOL implantation, which was described by Tablante *et al*[7] in 1988. It consists of a pars plana lensectomy with anterior vitrectomy preceded by epilenticular lens implantation into the ciliary sulcus. The technique greatly reduces the incidence of VAO and is particularly useful in cases of unilateral trauma where the posterior capsular status is unknown.

The major obstacle to rapid permanent visual rehabilitation is the opacification of the visual axis. Vasavada and Desai,[2] and Vasavada *et al*[3] have reported that no VAO occurred in eyes undergoing PCCC with vitrectomy.[2,3] However, Alexandrakis *et al*[18] have reported a 2% incidence of VAO in children more than 6 months old even after posterior capsulotomy and vitrectomy. Since the central posterior capsule and the anterior vitreous was removed in both of our study groups, the potential source for VAO was eliminated. In our study, VAO developed in only one case of traumatic cataract aged 8 years in the group B2 (Grade 2+ VAO developed after 8 months of the surgery). This was probably due to the greater postoperative inflammatory reaction seen in cases of traumatic cataracts, which led to closure of the small opening of the PCCC. Whereas, in the epilenticular technique a large posterior capsulotomy is possible without compromising the IOL stability.[9]

Vasavada *et al*[3] reported a visual outcome of 6/12 or better in 62% eyes after a follow up of 21.04 months with in-the-bag IOL implantation technique. Ghosh *et al*[9] performed epilenticular IOL implantation and reported a visual acuity better than 6/12 in 80% patients at the end of 1 year. A comparative evaluation of the two techniques, in our study, revealed a similar visual outcome (Table 2). The visual gain in the traumatic cataract group was poorer as compared to the developmental group.

In total, 35/40 eyes had mild to moderate uveitis on day 1 in the form of anterior chamber cells and flare. The uveitis took a little longer to resolve in the epilenticular group but by 3 months, none of the eyes in either group had any persistent uveitis. Severe inflammatory reaction was not seen in any of our cases. Other workers have also reported the absence of such reaction in their cases.[2,11,19] The lack of severe fibrinoid response was probably due to use of tunneled incision, good viscoelastics, use of frequent topical steroids, and depot steroid injection in the immediate postoperative period, and the older age group (more than 2 years) studied. A more aggressive inflammatory response occurs in children less than 2 years.

Sharma *et al*[20] in their review of 39 eyes of patients with paediatric cataract, who had undergone extracapsular cataract extraction with IOL implantation reported pigment deposition on the IOL in 30.8% cases. In our study, at the end of 3 months follow-up, 20.8% eyes in group A (epilenticular) and 6.3% eyes in group B (ACCC, PCCC) had IOL deposits. The difference between the two groups (though not statistically significant P-value = 0.373) suggests that sulcus implantation of the IOL in the epilenticular group encourages greater pigment deposition than in-the-bag IOL implantation, at least in early postoperative period. However, on long-term follow-up of our patients in the epilenticular group, we found no increased risk of pigment dispersion due to rubbing of IOL optic of the sulcus fixated lens against the posterior surface of iris.

One case of mild geometric IOL decent ration (1 mm) was noted after full dilatation of the pupil in group A (epilenticular group) in a child with traumatic cataract. The patient had no visual complaints and no intervention was required. The IOL remained centred and stable in all eyes in group B (ACCC, PCCC group). This suggests that sulcus implantation of the IOL may lead to a mild decentration in some cases while in-the-bag IOL implantation results in a more physiological placement of the IOL with less chances of decentration.

Various studies have reported IOL dislocation rates ranging from 3–20%[1,21] IOL dislocation is a potential risk after primary posterior capsulotomy and vitrectomy especially when the opening is large as in the epilenticular IOL group. In our series, there were no cases of IOL dislocation, subluxation, or pupillary capture in any of the groups. Fortunately, we did not have any case with extensive iris tear or dialysis in our study. These ocular injuries can lead to increased risk of pupillary capture of a sulcus implanted IOL.

Retinal detachment is reported as a late complication of paediatric cataract surgery occurring 20–30 years after surgery in 5–11% cases.[21] There was no evidence of retinal detachment or glaucoma in any of the groups. This needs to be studied over a longer period.

Cystoid macular edema (CME) is a rare complication after paediatric cataract surgery.[21,22] We detected one case of macular edema in group A1 (epilenticular) with developmental cataract, which subsided with a short course of systemic steroids and the patient maintained good vision thereafter. Sulcus implantation of IOL by epilenticular technique has been successfully performed by other workers.[7,9] They have not reported an increased incidence of complications, for example, RD, CME, pigment deposits on the lens, IOL decentration, or pupillary capture in their cases.

No case of macular edema was detected in group B (Table 3).

A comparison of the two techniques, epilenticular IOL implantation *vs* ACCC, PCCC with anterior vitrectomy and in-the-bag IOL implantation shows that they both have a good visual outcome without significant long-term VAO. Performing a successful anterior and posterior capsulorhexis in paediatric eyes is technically demanding. It may not be feasible in fibrotic or calcified cataracts or if the posterior capsular status is unknown. It is also essential to use high viscosity viscoelastics like Healon GV to perform these manoeuvres, which may increase the overall cost of surgery, an important concern in developing countries.

Epilenticular IOL implantation with pars plana lensectomy and vitrectomy also requires skill and patience and a clear knowledge of the potential risks associated with this technique. Although not statistically significant in our study groups, the postoperative visual gain was earlier and greater in patients who underwent ACCC, PCCC with vitrectomy as compared to the epilenticular group. The anterior chamber reaction and IOL deposits were also less and resolved earlier in the ACCC, PCCC group. Better IOL centration was maintained with in-the-bag IOL implantation than with sulcus implantation.

Traumatic cataracts pose special problems during surgery as was seen in four of our cases where ACCC, PCCC with vitrectomy and in-the-bag IOL implantation could not be done. Two cases had fibrotic or calcified capsules with intercapsular adhesions, which precluded an in-the-bag IOL implantation. Two cases had large pre-existing posterior capsular rents, which would have enlarged, during surgery leading to vitreous prolapse, had we persisted in completing the lens aspiration. Safe in-the-bag IOL implantation would also have been difficult, if not impossible in these cases.

The unknown status of the posterior capsule, a ruptured anterior capsule, capsular-cortical bands, or intercapsular adherence, the presence of posterior capsular plaques partially absorbed membranous cataracts, fibrotic or calcified capsules, and posterior synechiae are some situations that may be encountered singly or in combination in traumatic cataracts. These may prevent a successful in-the-bag IOL implantation. If detected preoperatively, they could form the basis of a planned epilenticular surgery rather than an attempt to change the surgical technique midway through a compromised endeavor. These findings indicate that epilenticular implantation has an edge over ACCC, PCCC with vitrectomy in cases of traumatic cataract. This highlights the applicability of an alternate procedure with a good visual outcome in situations where in-the-bag IOL implantation is technically difficult or impossible. We recommend that, in cases of traumatic cataract where we can predict the presence of posterior capsular rupture or in cases of partially absorbed membranous cataract with calcified capsule, a primary epilenticular IOL implantation should be planned.

Conclusion

ACCC, PCCC with vitrectomy, and in-the-bag IOL implantation remains the procedure of choice for management of paediatric cataract. Epilenticular IOL implantation is a safe and effective alternative, especially in traumatic cases. It ensures a clear visual axis and stable IOL implantation with adequate centration. A longer follow-up would reveal further information regarding the long-term safety and efficacy of this procedure.

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References

1 Buckley EG, Klombers LA, Saebar JH, Scalise-Gordy A, Minzter R. Management of the posterior capsule during pediatric intraocular lens implantation. *Am J Ophthalmol* 1993; **115**: 722–728.
2 Vasavada A, Desai J. Primary posterior capsulorhexis with and without anterior vitrectomy in congenital cataracts. *J Cataract Refract Surg* 1997; **23**: 645–651.
3 Vasavada AR, Trivedi RH, Singh R. Necessity of vitrectomy when optic capture is performed in children older than 5 years. *J Cataract Refract Surg* 2001; **27**: 1185–1193.
4 Dahan E, Salmenson BD. Psueudophakia in children. Precautions, technique and feasibility. *J Cataract Refract Surg* 1990; **16**: 75.
5 Gimbel HV. Posterior capsulorhexis with optic capture in pediatric cataract and intraocular lens surgery. *Ophthalmology* 1996; **103**: 1871–1875.
6 Gimbel Howard V. Posterior continuous curvilinear capsulorhexis and optic capture of the intraocular lens to prevent secondary opacification in pediatric cataract surgery. *J Cataract Refract Surg* 1997; **23**: 652–656.
7 Tablante RT, Cruz EDG, Lapus JV, Santos AM. A new technique of congenital cataract surgery with primary posterior chamber intraocular lens implantation. *J Cataract Refract Surg* 1988; **14**(2): 149–157.
8 Merih O, Sengul CO, Murat K. Berati Hasanreisoglu. Pars plana lensectomy with double-capsule-supported intraocular lens implantation in children. *J Cataract Refract Surg* 2000; **26**: 486–490.
9 Ghosh B, Gupta AK, Taneja S, Gupta A, Mazumdar S. Epilenticular lens implantation versus extracapsular cataract extraction and lens implantation in children. *J Cataract Refract Surg* 1997; **23**: 612–617.

10 Dahan E, Drusedau MUH. Choice of lens and diopteric power in pediatric psedophakia. *J cataract Refract Surg* 1997; **23**: 618–623.
11 Raina UK, Gupta V, Arora R, Mehta DK. Posterior continuous curvilinear capsulorhexis with and without optic capture of the posterior chamber intraocular lens in the absence of vitrectomy. *J Pediatr Ophthalmol Strabismus* 2002; **39**: 278–287.
12 Zetterstrom C, Kugelberg U, Oscarson C. Cataract surgery in children with capsulorhexis of anterior and posterior capsules and heparin-surface modified intraocular lenses. *J Cataract Refract Surg* 1994; **20**: 599–601.
13 Taylor D, Vaegan, Morris JA, Rodgers JE, Warland J. Ambylopia in bilateral infantile an juvenile cataract. Relationship to timing of treatment. *Trans Ophthalmol Soc UK* 1979; **99**: 170–175.
14 The Pediatric Eye Disease Investigator Group. A randomized trial of patching regimens for treatment of moderate ambylopia in children. *Arch Ophthalmol* 2002; **121**: 603–610.
15 Fenton S, O'Keefe M. Primary posterior capsulorhexis without anterior vitrectomy in pediatric cataract surgery, longer term outcome. *J Cataract Refractive Surg* 1999; **25**: 763–767.
16 Peyman GA, Raichand M, Oesterie C, Goldberg MF. Pars plicata lensectomy and vitrectomy in the management of congenital cataracts. *Ophthalmology* 1981; **88**: 437–439.
17 Hoyt CS, Nickle B. Aphakic cystoid macular edema:occurrence in infants and children after transpupillary lensectomy and anterior vitrectomy. *Arch Ophthalmol* 1982; **100**: 746–749.
18 Alexandrakis G, Peterseim M, Wilson ME. Clinical outcomes of pars plana capsulotomy with anterior vitrectomy in pediatric cataract surgery. *J AAPOS* 2002; **6**: 163–167.
19 Raina UK, Mehta DK, Monga S, Arora R. Functional outcomes of acrylic intraocular lenses in pediatric cataract surgery. *J Cataract Refract Surg* 2004; **30**(5): 1082–1091.
20 Sharma N, Pushkar N, Dada T, Vajpayee RB, Dada VK. Complications of pediatric cataract surgery and intraocular lens implantation. *Cataract Refract Surg* 1999; **25**: 1585–1588.
21 Hiles DA, Watson BA. Complications of implant surgery in children. *AM Intra Ocular Implant Soc J* 1979; **5**: 24–32.
22 Francois J. Late results of congenital cataract surgery. *Am J Ophthalmol* 1978; **86**: 1586–1598.