ORIGINAL ARTICLE

Hydrophilic Versus Hydrophobic Acrylic Intraocular Lens Implantation in Paediatric Cataract Surgery

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ABSTRACT

Introduction: The selection of intraocular lens is still debatable in paediatric eye. Due to low cost and fewer intra-operative complication hydrophilic acrylic intraocular lens are implanted in volume in low income countries. There is lack of comparative study of this type of lens with hydrophobic lens in paediatric population. **Aims:** To compare the outcomes of hydrophilic acrylic lens and hydrophobic acrylic lens in paediatric cataract surgery. **Methods**: Out of 48 eyes included in the study, the Group A (n =24) eyes were implanted with acrylic hydrophilic intraocular lens, and the Group B (n =24) were implanted with acrylic hydrophobic intraocular lens. The children were evaluated pre, intra and postoperatively for different parameter. **Results**: The mean age was 6.6±2.7 years at the time of surgery. The most common type of cataract was zonular (58% in Group A and 50% in Group B). Postoperatively, corneal edema was seen in 7(29%) eyes in group A and in 2(8%) eyes in group B. The mean follow-up was 16.9±2.9 months. At one year, the position of the intraocular lens was in the capsular bag in 20 eyes (88.33%) and 24 eyes (100 %) in the group A and B, respectively. Clear visual axis was present in 22 eyes in Group A and 24 eyes in Group B. Posterior capsule opacification occurred in 12(50%) eyes in Group A and 6(25%) eyes in Group B. Two (8.3%) eyes in group A underwent surgical membranectomy due to visual axis opacification. The mean LogMAR visual acuity was 0.56 and 0.52 in group A and B respectively at one year. **Conclusion**: Hydrophilic acrylic intraocular lens are good alternative to hydrophobic intraocular lens in Nepal in the treatment of paediatric cataract.

Keywords: Cataract, Children, Intraocular lens

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INTRODUCTION

Cataract is one of the leading causes of childhood visual impairment and blindness in developing countries.[1] There are many controversies in pediatric cataract management regarding timing of surgery, intraocular lens (IOL) power calculation, and the choice of IOL. The choice of IOL mainly depends upon factors like material biocompatibility, posterior capsule opacification, size of wound, and the cost of IOL, especially in developing countries like Nepal.[2]

There is trend away from rigid PMMA and in favour of foldable acrylic IOL implantation in child because of a desire for a highly biocompatible material that could be inserted through a smaller incision, which would fit the smallest capsular bag without excessive stretching.[3] Performing posterior capsulotomy and anterior vitrectomy in the same surgical session as cataract extraction is effective in preventing PCO obscuring the visual axis (VAO).[3,4] There are many studies have shown good outcome, in the older practice of using rigid polymethyl methacrylate) (PMMA) lenses and the newer hydrophobic lenses as well as in hydrophilic lenses in children with cataract.[2-8] However, there is lack of studies comparing the outcome of hydrophilic and hydrophobic lenses in the pediatric age group. Thus, this study was conducted to compare the outcome of pediatric cataract surgery with hydrophilic and hydrophobic IOL implantation in Nepalese children.

METHODS

This was a hospital based prospective study conducted at the Ophthalmology department of the Nepalgunj Medical College from January, 2020 to December, 2022. The study was approved by the institutional review committee of the Nepalgunj Medical College, Kohalpur, Banke.

Informed consent was obtained from the parents of the children before enrolling them in the study. Inclusion criteria were children age 3 to 15 years with visually significant congenital or developmental cataract, and partial or dense cataract involv-

ing 3mm or more of the central visual axis. Whereas exclusion criteria were presence of an associated ocular disease, such as micro-ophthalmia, microcornea, glaucoma, uveitis, complicated cataract, posterior lenticonus, coloboma, subluxated lens, retinal lesions, such as retinal detachment and retinal holes; suspected pre-existing posterior capsular defects, such as traumatic cataract; systemic diseases; and axial length of the eye <17 mm. IOL power calculation was done using the SRK II undercorrecting 20% for children less than 2 years and 10% for children 2–8 years old.[9] The children were randomly divided into 2 groups. Group A comprised children whose eyes were implanted with square-edge, acrylic hydrophilic lenses (ultima, Care Group Solution Pvt Ltd, Vadodara, Gujarat, India) with optic size of 6.0 mm and an overall diameter of 13.0 mm. Group B comprised children whose eyes were implanted with square-edge, acrylic hydrophobic IOLs with optic size of 6.0 mm and an overall diameter of 13.0 mm, (Spectraphob, Care Group Solution Pvt Ltd, Vadodara, Gujarat, India). Preoperatively, topical moxifloxacin 0.5% was instilled 6 times a day for 1 day. Mydriasis was achieved with 1% cyclopentolate 1% tropicamide and 5% phenylephrine instilled 3 times half hourly before the surgery. A single surgeon performed all the surgeries under general anesthesia. After the patient had been cleaned and draped, universal eyelid speculum was applied. A clear corneal incision was made at 11 0' clock position with a 2.8 mm keratome. Air bubble was injected in the anterior chamber. Trypan blue dye was injected then to stain anterior capsule of lens. Dye was cleaned with Balance salt solution. Hydroxypropyl methylcellulose (2%) visco-elastic material was injected into the anterior chamber. Continuous curvilinear capsulorrhexis (CCC) of approximately 5mm was made with the help of a capsulotomy needle or capsulorhexis forceps. One side port incision was made. Hydro-dissection and aspiration of the cortical matter was performed with Simcoe two-way irrigation aspiration canula. Primary posterior capsulotomy (PPC) was performed in child less than 8 years of age. The size of the PPC was approximately 3–3.5 mm. Limited anterior vitrectomy was performed in the area of the PPC. This was followed by IOL implantation. The remaining viscoelastic substance was removed using Simcoe two-way irrigation aspiration canula. The main incision was closed with stromal hydration or using 10-0 nylon suture. Gentamicin 0.5 ml (20 mg) and dexamethasone 0.5 mL (2 mg) were injected into the subconjunctival space and the eye was patched. In the immediate postoperative period 24 hours after surgery, topical moxifloxacin 0.5% was instilled 8 times a day and corticosteroid eyedrop (Prednisolone 1%) was used 8 times a day. Atropine 1% was used once a day for 4 weeks. Children were evaluated on day 1, at 1 week, 4 weeks, 12 weeks, and 24 weeks postoperatively, then every 3 months.

The parameters evaluated were anterior chamber reaction (synechiae, fibrin), IOL position, PCO and VAO, intraocular pressure, BCVA, corneal status, and refractive error. Visual acuity was measured in older children and children who cooperated with Snellen's visual acuity chart. The intraocular pressure was taken by noncontact tonometer. The corneal status, anterior chamber reaction, and IOL position was assessed with the help of slit-lamp biomicroscopy. Retinoscopy was done and BCVA was assessed in cooperative children. In younger or uncooperative children, detailed examination was carried out in the operative room with operating microscope under anesthesia.

Statistical analysis

BCVA, retinoscopy,keratometry and axial length were compared using t test. All other parameters, such as sex distribution, postoperative corneal status, visual axis opacification (VAO), PCO, membranectomy rates for significant VAO, and postoperative complications (e.g., occlusiopupillae and optic capture) were analyzed using the x2 test. A p value of < 0.05 was considered statistically significant. The statistical calculations were done using Software Package for the Statistical Sciences v. 13.0 (SPSS Inc, Chicago, Ill).

RESULTS

There were 68 children with congenital cataract underwent cataract surgery during study period. Out of them 48(26 male and 22 female) children were included in the study who met the inclusion criteria. Age ranged from 3 year to 14 years. The mean age was 6.6±2.7 years. The mean age was 7.42±2.9 years in Group A and 5.79±2.2 years in Group B (p = 0.56). The mean value of axial length in Group A was 22.34±1.01 mm and in Group B was 22.15±0.94 mm (p = 0.46) (Table 1). The mean value of keratometry in Group A was 42.88±1.83 D and in Group B was 43.08±1.62 D. In both groups the most common type of cataract was zonular type accounting 58% in Group A and 50% in Group B. Other types of cataracts were posterior sub capsular cataract and total cataract (Table I).

Parameter	Group A Hydrophilic	Group B Hydrophobic	p-value
Sex n (%)			
Male	12	14	0.562
Female	12	10	
Mean Age (years)	7.42±2.9	5.79±2.2	0.657
Axial length mean(SD)mm	22.34± 1.01	22.15± 0.94	0.46
Average Keratometry	42.88± 1.83	43.08± 1.62	0.81
Mean LogMAR VA	1.91±0.81	2.08±0.94	0.201
Types of cataract n			0.803
Zonular	14	12	
Posterior sub capsular	4	4	
Total cataract	6	8	

Table I: Preoperative profile of children implanted with Hydrophilic and hydrophobic Intraocular lenses

Intraoperative capsular dehiscence occurred in one eye in group A which underwent scleral fixation of intraocular lens, thus excluded from the study. One eye in each group observed with Intraoperative Hyphema which was managed with temporary air tamponade in both cases. Eccentric capsulotomy occurred in one eye in both groups which did not cause any difficulties.

Postoperatively, Cornea was hazy due to edema in 7 eyes (29%) in hydrophilic IOL group whereas in 2 eyes (8%) in hydrophobic

IOL group. Corneal edema subsides with topical instillation of steroid and hypertonic saline in subsequent visits. At one year corneal clarity was present in all eyes in both groups. Anterior chamber inflammation subsided over a period of 4–6 weeks with topical steroid Prednisolone 1% instilled 10–12 times and reduced over a period of 4- 6 weeks. One eye in each group had significant anterior chamber reaction with fibrin membrane formation over the IOL in the postoperative period, but this resolved with frequent topical and oral steroid. At one year postoperatively the position of the IOL was in the capsular bag in 20 eyes (88.33%) and 24 eyes (100 %) in the acrylic hydrophilic and acrylic hydrophobic group, respectively. The IOL position in 4 eyes (11.67%) in Hydrophilic IOL group was in ciliary sulcus. Clear visual axis was present in 22(91.7%) eyes in Group A and 24 (100%) eyes in Group B (table II). PCO occurred in 12 (50%) eyes in Group A and 6 (25%) eyes in Group B at 12 months follow-up. Two (8.3%) eyes in group A underwent surgical posterior capsulotomy and anterior vitrectomy whereas all other were in close follow up as PCO was not obscuring visual axis. PCO rate was higher in Group A (hydrophilic IOL) at 12th postoperative month than in Group B (hydrophobic IOL) but was not statistically significant (chi square test p=0.221).

Parameter		Group A	Group B	p value
corneal clarity at post operative day 1	clear	17	22	
	hazy	7	2	
corneal clarity at 6 week or later	clear	24	24	
Intraocular lens position	capsular bag	20	24	
	ciliary sulcus	4	0	
Visual axis clarity at 1 year	Clear	22	24	
	Opacified(PCO)	10	6	P=0.221
	surgical capsulotomy (VAO)	2	0	
Intraoperative complications	Eccentric capsulotomy	1	1	
	capsular bag dehiscence	1	0	
	Hyphema	1	1	
	Small capsulorrhexis	1	1	
	posterior capsule rupture	1	0	
	primary posterior capsular opacification	0	2	
Post operative complications	posterior capsular opacification	12	6	
	corneal edema	7	2	
	Fibrinous uveitis	1	0	
	Raised IOP	1	1	
Best corrected Visual acuity at 1 year follow up	≥20/40	11	9	
	20/60-20/400	12	14	
	<20/400	1	1	
Mean LogMAR VA at 1 year follow up		0.56±0.41	0.52±0.39	p=0.72

Table II: Intraoperative complications and Post operative profile of children implanted with hydrophilic and hydrophobic Intraocular lens

There were 11 eyes (11 children) in Group A and 9 eyes (9 children) in Group B who were able to read at a 20/40 level or better. The mean LogMAR visual acuity was 0.56 and 0.52 in group A and B respectively at 1 year follow up showing no statistical significance differences between two groups(p=0.72 independent T test) whereas The Mean LogMAR visual acuity improved significantly(p=0.00 paired T test) at 1 year follow up from preoperative LogMAR Visual acuity. In the acrylic hydrophilic group, 9 eyes showed hypermetropia, and 15 eyes were myopic, where as in the acrylic hydrophobic group 12 eyes had myopia, 6 eyes had hypermetropia and 6 eyes were emmetropic at 1 year postoperatively (Table III). The mean follow-up was 16.9±2.9 months. The minimum follow-up was 12 months and maximum 24 months.

Spherical equivalent at 12 month D	Group A			Group B		
	Myopia	Hypermetropia	Emetropia	Myopia	Hypermetropia	Emetropia
Emetropia			0			0
0.5-2.00	15	8		11	5	
>2.00	0	1		1	1	

Table III: Postoperative refractive error in spherical equivalent at 12 month

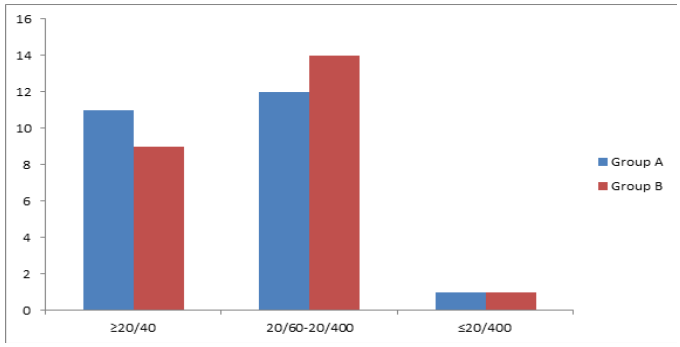

Figure 1: Best corrected visual acuity at 1 year postoperative follow up of eye in two groups

DISCUSSION

The management of cataract has numerous challenges in pediatric eye due to the differences in the biomechanical properties of the ocular tissue, difficult surgical techniques,

high rates of postoperative complications and suboptimal visual outcome in a significant proportion of patients.[10]

IOL implantation is the successful surgical treatment of aphakia in pediatric cataract surgery.[2,3,7] There are reports of implantation of rigid poly methyl metha acrylate (PMMA), hydrophobic acrylic, hydrophilic acrylic and silicone IOLs.[2,3,5-7] Due to higher intraoperative complications and large incision size surgeons are limiting the use of PMMA IOL despite of its low cost and comparable PCO rate.[2,7] Irreversible silicone oil adhesion and poor posterior segment view limit the use of silicone IOLs.[11] So nowadays Hydrophilic acrylic IOL are implanted in large proportion in developing world due to its low cost whereas hydrophobic IOL in developed Countries. This study aimed to compare two of the most commonly implanted IOLs in the treatment of pediatric cataract, i.e. acrylic hydrophilic and acrylic hydrophobic.

In the index study, similar visual outcomes were observed in both groups at one year. The 46% of eyes achieved a BCVA of 20/40 or better in group A and 38% in group B whereas 96% of eyes achieved a BCVA of 20/400 or better in both groups at one year follow up. In previous study by Adhikari et al using the hydrophilic IOL resulted in a BCVA of ≥20/40 in 45 % of the eyes[2] similar to the index study whereas Panahi-Bazaz et al[12] reported it in higher proportion (80%) of cases. The BCVA of ≥ 20/400 was observed in 95% of cases similar in to the result of previous studies.[2,12] Similarly previous study using hydrophobic IOL by Bhusal et al[3] reported a BCVA of ≥20/40 in 33% of the eyes consistent to our findings. The most common complications reported in group A [posterior capsule opacification (PCO); n= 12,50%] and group B (posterior capsule opacification (PCO); n= 6,25%) were consistent with those reported in literature.[2,3,7,12,13] The 2 eyes in hydrophilic acryl group developed visual axis opacification (VAO) but none of the eye in hydrophobic acryl group developed VAO. The eyes with VAO underwent surgical membranectomy to obtain clear visual axis i.e. 8.3% in group A and 0% in group B. The membranectomy rate was 33% in the study by Bhusal et al[3] in hydrophobic IOL group.

CONCLUSION

In conclusion, we found that both hydrophilic acrylic and hydrophobic acrylic IOLs were compatible and safe for use in pediatric cataract surgery with similar visual axis clarity and postoperative outcome. Hydrophilic acrylic intraocular lens are good alternative to hydrophobic intraocular lens in low income country like Nepal in the treatment of paediatric cataract.

LIMITATION

A limitation of our study was the small sample and short duration of follow-up.

REFERENCES

1. Foster A, Gilbert C, Rahi J. Epidemiology of cataract in childhood: a global perspective. J Cataract Refract Surg. 1997;23 Suppl 1:601–604.
2. Adhikari S, Shrestha UD.Pediatric cataract surgery with hydrophilic acrylic intraocular lens implantation in Nepalese children.Clinical Ophthalmology 2018:12: 7–11
3. Bhusal S, Ram J, Sukhija J, Pandav SS, Kaushik S. Comparison of the outcome of implantation of hydrophobic acrylic versus silicone intraocular lenses in pediatric cataract: prospective randomized study. Can J Ophthalmol 2010;45:531–6. doi:10.3129/i10-045
4. Guo S, Wagner RS, Caputo A. Management of the anterior and posterior lens capsules and vitreous in pediatric cataract surgery. J PediatrOphthalmol Strabismus. 2004;41: 330-337.
5. Trivedi RH, Wilson ME Jr. Single-piece acrylic intraocular lens implantation in children. J Cataract Refract Surg. 2003; 29 (9):1738–1743.
6. Nihalani BR, Vasavada AR. Single-piece AcrySof intraocular lens implantation in children with congenital and developmental cataract. J Cataract Refract Surg. 2006; 32 (9):1527–1534.
7. Rowe NA, Biswas S, Lloyd IC. Primary IOL implantation in children: a risk analysis of foldable acrylic v PMMA lenses. Br J Ophthalmol. 2004;88 (4):481–485.
8. Aasuri MK, Fernandes M, Pathan PP. Comparison of acrylic and polymethyl methacrylate lenses in a pediatric population. Indian J Ophthalmol. 2006;54 (2):105–109.
9. Dahan E, Drusedau MU. Choice of lens and dioptric power in pediatric pseudophakia. J Cataract Refract Surg 1997; 23(Suppl):618–23.
10. Medsinge A, NischalKK.Pediatric cataract: challenges and future directions. ClinOphthalmol. 2015; 9:77–90.
11. Apple DJ, Federman JL, Krolicki TJ, Sims JC, Kent DG, Hamburger HA, Smiddy WE, Cox MS Jr, Hassan TS, Compton SM, Thomas SG. Irreversible silicone oil adhesion to silicone intraocular lenses. A clinicopathologic analysis. Ophthalmology. 1996 Oct;103 (10):1555-61; 1561-2. doi: 10.1016/s0161-6420(96)30463-6.
12. Panahi-Bazaz MR, ZamaniM, Abazar B. Hydrophilic Acrylic vs PMMA IOLs in Children. J Ophthalmic Vis Res 2009; 4 (4): 201-207.
13. Batur et al, Posterior Capsular Opacification in Pediatric Cataract. Turk J Ophthalmol 2016;46:205-208.