

# Viscosealing: A novel technique for port closure in pediatric cataract surgery

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## Abstract

**Purpose:** The purpose of this study was to evaluate the efficacy and outcome of viscosealing of incisions made during pediatric cataract surgery.

**Design:** This was a prospective case series.

**Participants:** A total of 96 eyes of 65 patients aged <10 years were included.

**Methods:** Analysis of all children with congenital cataract who underwent cataract surgery with intraocular lens implantation and sealing of the side port with 1.45% sodium hyaluronate was done at a tertiary care center. In all the patients', phacoaspiration with primary posterior capsulorhexis and anterior vitrectomy was done.

**Results:** Mean age at surgery was 42.76 months (3.5 years  $\pm$  3.1 years). Complications encountered were irregular pupil in 6 eyes (6.25%), iridolenticular adhesions in 8 eyes (8.3%), and shallow anterior chamber in 6 eyes (6.25%) postoperatively. Most of these complications were seen in children <6 months of age (65.3%). At 3 months postoperatively, the mean spherical equivalent was 1.34 DS  $\pm$  2.86 D and mean astigmatism  $-0.05 \pm 1.55$  D.

**Conclusion:** Viscosealing is an effective way to close side ports in children above 6 months of age. It does away with suture-related problems and need for the 2<sup>nd</sup> time general anesthesia.

## Introduction

Anatomical and functional outcomes still pose significant problems after pediatric cataract surgery despite the advances that have occurred in this field during the past 10 years. Visually significant cataract requires early and meticulous surgery as the outcome often depends on the technique of surgery. Advances in technology, techniques involving intraocular lens (IOL) implantation, wound construction, and capsule management promise to improve long-term outcomes. However, post-operative refractive error and amblyopia pose the biggest hurdles in visual rehabilitation in these children.

Unlike in adults, tunnel incisions do not self-seal in children. A survey by Wilson<sup>[1]</sup> reported that only 19.8% of their survey responders left the main incision as well as the paracentesis ports unsutured. Due to the elasticity of the pediatric eyewall and perhaps greater use of steroids which delay wound healing,

the consensus is suturing the incision and paracentesis port in children. Viscoelastics are used as the third hands in cataract surgery in adults as well as children. We describe our experience with the technique of viscosealing of the ports in the management of congenital cataract in children as well as the advantages of this new technique. To the best of our knowledge, this is the first reported series of its kind.

## Methods

A chart review was performed on all pediatric patients under the age of 10 years who had cataract surgery with IOL implantation performed by one surgeon at a tertiary center in North India. Informed consent was obtained from parents. The study was approved by the institute (PGI) ethics committee. All patients had infectious and metabolic screening to identify any potential cause of the cataracts.

Inclusion criteria were patients under 10 years diagnosed with congenital cataract who underwent phacoaspiration and IOL implantation in the bag/sulcus, ports closed with viscoelastic, and follow-up of 3 months. Patients were excluded if they had corneal abnormalities (such as a corneal scar) or if a retinoscopic refraction could not be performed due to any reason. Data collected included the age at surgery, laterality, sex of the child, birth-related complications, significant family history, type of cataract, axial length preoperatively, type and power of IOL, complications if any, and post-operative retinoscopy/refraction at last follow-up visit.

IOL power calculations were performed using immersion A-scan ultrasonography for axial length measurements and keratometry using a handheld keratometer.

**Surgical technique**

All surgeries were performed by the same surgeon (J.S.) under general anesthesia using standard technique. The pupil was dilated preoperatively with a combination of cyclopentolate 0.25%, tropicamide 0.25%, and phenylephrine 2.50%. Two limbal side port tunnels (1 mm wide) were made at 3 O'clock and 9 O'clock using 15° paracentesis knife. Trypan blue was injected to aid visualization of the anterior capsule. Anterior chamber was formed with sodium hyaluronate 1.4%. Posterior limbal incision was made at 11'O clock with 3.0 mm keratome knife and continuous anterior capsulorhexis of approximately 5.0 mm diameter was performed with Utrata forceps. Aspiration of the lens was accomplished using an automated irrigation/aspiration handpiece.

Primary posterior capsulotomy of 3.5 mm and anterior vitrectomy were performed by the anterior route through the same limbal side ports.

In all patients in the bag hydrophobic IOL, implantation was attempted. The residual ophthalmic viscosurgical device was removed. Thereafter, a drop of cohesive viscoelastic was placed at entry margin of both side port tunnels (2'O clock and 9'O clock) into the anterior chamber and an air bubble was injected until one-third of the anterior chamber. Seidel test was done to confirm that the wounds were watertight (Submitted video). Topical antibiotic was instilled and the eye covered with an eye pad and plastic shield.

Seidel's testing was repeated on the 1<sup>st</sup> day for all patients. All patients were treated postoperatively with prednisolone acetate 1% eye drops every hour for the 1<sup>st</sup> week followed by tapering over the next 6 weeks. Topical moxifloxacin was given 4 times a day for 1 week postoperatively. Homatropine drops were given for a week.

Follow-up visits were performed at 1 day, 1 week, 1 month, and 3 months after surgery. Retinoscopy/refraction was performed at 1–3 months postoperatively by a trained optometrist. Optical correction was combined with occlusion therapy for amblyopia where needed. A record of the subsequent examinations under anesthesia including the adverse effects was noted.

**Results**

A total of 96 eyes of 65 patients were enrolled in our study [Table 1]. There were 19 females and 46 males. The mean age of the patients at the time of surgery was 42.76 months (3.5 years ± 3.1 years, range 5 months–10 years). 44 left eyes were operated and 52 right. 78 eyes had total congenital cataract and 18 had lamellar cataract.

Age appropriate visual acuity testing was done, wherever the child was cooperative enough, but we could not collect significant data retrospectively to analyze as far as the visual acuity was concerned. In all eyes, anterior capsulorhexis with lens aspiration, posterior capsulotomy, and anterior vitrectomy were successfully performed with implantation of hydrophobic IOL AMO (Sensar™ OptiEdge, Tecnis acrylic; Abbott Medical Technologies, Santa Ana, California), and Hoya (AF Series; Hoya, Japan). 80 eyes (83.3%) had in the bag IOL, 10 in the sulcus, and 6 eyes optic capture with haptics in ciliary sulcus was done. In all patients, no suturing of the main incision or side port was done. There was no leakage or shallowing of anterior chamber at the end of surgery.

On the 1<sup>st</sup> post-operative day, all but 6 eyes had well-formed anterior chamber. However, 1/6 eyes required suture closure as shallow anterior chamber persisted until day 3. No cases of hyphema, retinal detachment, or endophthalmitis were observed. Complications encountered were significantly more in children <6 months (P = 0.04, Table 2). At 3 months follow-up, mean spherical equivalent was 1.30 DS ± 2.86 D with astigmatism of about -0.05 ± 1.55 D.

Two patients had post-operative intraocular pressure (IOP) spikes detected on subsequent examinations under anesthesia. Case 1 (9 months old) had an IOP of 20 mmHg in the 1<sup>st</sup> month

**Table 1:** Age-wise distribution of children

Age group	Number of children
≤6 months	10
7–12 months	12
1–2 years	19
2–5 years	13
>5 years	11
Total	65

**Table 2:** Complications encountered with the technique of viscosealing

Complications	Number (%)	Number in <6 months
Irregular pupil	6 (6.25)	5
Iridocapsular adhesions	8 (8.3)	5
Shallow anterior chamber	6 (6.25)	4
Iris adherent to side port	6 (6.25)	3
	26	17 (65.3%) p=0.04

and case 2 (3 years old; sulcus fixation of IOL) had an IOP of 22 mmHg at the 6<sup>th</sup> week visit postoperatively. Both of them were started on topical drugs only (dorzolamide 2% tid). IOP had the last recorded, follow-up was normal.

## Discussion

Cataract surgery in children differs from adults in several aspects. Peculiar ocular anatomy combined with exaggerated response to surgical trauma leads to great difficulties intraoperatively. Over the years, latest advancements have led pediatric surgeons to overcome intraoperative problems, but poor cooperation and refractive errors leading to amblyopia disappoint a fairly well-done surgery. Various authors have aimed at ways to decrease residual refractive error and astigmatism after pediatric cataract surgery. Post-operative astigmatism is of greater importance in children than adults due to greater chances of developing amblyopia. Our study aims to do the same by reducing the suture-induced astigmatism in pediatric cataract cases. We present the data of 96 eyes with congenital cataract in which phacoaspiration with IOL implantation was successfully performed without suturing the main or the side port with minimal astigmatism postoperatively.

The sutures in pediatric cataract surgery are more of a safety precaution, to avoid wound leakage as a result of decreased scleral rigidity. Since the pediatric eyes are much softer than the eyes of adults and pediatric patients may be more prone to trauma and less compliant, it is safer to suture pediatric wounds.<sup>[2-4]</sup>

Basti *et al.* showed that self-sealing wounds failed to remain watertight in children below 11 years of age but recommended suturing even older children since post-operative eye rubbing is common.<sup>[5]</sup> The authors attribute the poor self-sealing to low corneal rigidity resulting in fish mouthing of the wound, leading to poor approximation of the internal corneal valve to the overlying stroma.

We did not encounter any such problems in our patients. The tightness of the wound was ensured on table and aqueous leakage was prevented by viscosealing. Pre-operative and post-operative parents were counseled to restrain the children from eye rubbing as much as possible. All children were given dark glasses also to prevent the same. We used the superior approach so that bells phenomenon along with the incision is protected by the brow, gives more protection in trauma-prone years. Self-retaining high-molecular-weight viscoelastic substance plugs the wounds posing as a mechanical barrier. In adults, architectural analysis of wounds after phacoemulsification shows no epithelial gaping after post-operative day 1 by optical coherence tomography.<sup>[6]</sup> There is no similar literature in children, but we believe as the pediatric eyes have more inflammation, soon fibrosis sets into plug the wound and turn the mechanical barrier by the viscoelastic into a permanent seal.

A previous study<sup>[7]</sup> similarly documented successful secure self-sealing of sutureless wounds following pediatric ECCE with posterior capsule preservation and IOL insertion.

Not using sutures led to almost zero induction of post-operative astigmatism in our patients. Besides suture-induced astigmatism, this novel technique avoids additional follow-up for suture removal under general anesthesia and suture-related complications. The indications for suture removal in children are not only limited to induced post-operative astigmatism but also to complications such as local reaction, infection, and irritation promoting more eye rubbing that necessitates suture removal. The suture removal exposes the children to risk of infection which needs early and careful follow-up. Even better suture materials do not avoid intraoperative problems such as bleeding leading to hyphema, inflammation, greater surgical time, and vascularization of wounds.

In a study by Bar-Sela and Spierer,<sup>[8]</sup> children who had congenital cataract surgery with IOL implantation using clear corneal or scleral tunnel incisions had high post-operative astigmatism 1 week postoperatively. However, the astigmatism spontaneously regressed during the first 5 months of follow-up. After analyzing adult and pediatric eye surgery data, Chee and Lam<sup>[9]</sup> summed up that the wounds have virtually no effect on the development of post-operative astigmatism. The authors found out using 25 and 23 gauge vitrectomy system, the surgical wounds are rendered safe and secure and when created with a flat paracentesis knife, the incisions do not need to be closed.

IOP raising side effects of viscoelastics are well documented but are transient and dose related.<sup>[10,11]</sup> A small amount of viscoelastic in our cases could not have raised IOP. The two cases in our study might have secondary glaucoma due to other factors (age <1 year and sulcus-fixated IOL), which is well known after congenital cataract surgery. The half-life of sodium hyaluronate is also viscosity dependent but ranges on an average from 24 to 72 h when injected in the anterior chamber in experimental models.<sup>[11-13]</sup> The air bubble in the anterior chamber at the end of the surgery may be more beneficial in the cataract surgery, of especially pediatric age group, uveitis patients, and diabetics where we see higher inflammation as proven in a study in rabbit eyes.<sup>[14]</sup> Furthermore, an air bubble in the anterior chamber may have protective effects against the development of *Staphylococcus epidermidis* endophthalmitis.<sup>[15]</sup> The posterior synechia, pigments, and other signs of inflammation were very less in our study (6.25–8%). Perhaps, not suturing leads to less eye rubbing and hence less inflammatory sequelae.

However, the results of the present study show that children <6 months of age had greater complications in terms of adherence of iris to side port and post-operative shallow anterior chamber. We recommend this technique for all children above 6 months age as it would avoid the need for a second general anesthesia for the child and thus save on the cost and at the same time, the suture-related complications besides being an effective procedure.

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