

## Completion rates of anterior and posterior continuous curvilinear capsulorrhexis in pediatric cataract surgery for surgery performed by trainee surgeons with the use of a low-cost viscoelastic

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**Context:** Pediatric cataract surgery is traditionally done with the aid of high-molecular-weight viscoelastics which are expensive. It needs to be determined if low-cost substitutes are just as successful. **Aims:** The study aims to determine the success rates for anterior and posterior capsulorrhexis and intraocular lens (IOL) implantation in the bag for pediatric cataract surgery performed with the aid of a low-molecular-weight viscoelastic. **Settings and Design:** Nonrandomized observational study. **Materials and Methods:** Children less than 6 years of age who underwent cataract surgery with IOL implantation in the period May 2008–May 2009 were included. The surgeries were done by pediatric ophthalmology fellows. A standard procedure of anterior capsulorrhexis, lens aspiration with primary posterior capsulorrhexis, anterior vitrectomy, and IOL implantation was followed. Three parameters were studied: successful completion of anterior and posterior capsulorrhexis and IOL implantation in the bag. **Results:** 33 eyes of 28 children were studied. The success rate for completion was 66.7% and 88.2 % for anterior and posterior capsulorrhexis, respectively. IOL implantation in the bag was successful in 87.9%. **Conclusions:** 2% hydroxypropylmethylcellulose is a viable low-cost alternative to more expensive options similar to high-molecular-weight viscoelastics. This is of great relevance to hospitals in developing countries.

**Key words:** Capsulorrhexis, completion rates, pediatric cataract surgery

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A manual continuous curvilinear capsulorrhexis for the anterior capsule in pediatric cataract surgery affords the greatest resistance to tear and should be accomplished whenever possible.<sup>[1]</sup> However, capsulorrhexis in children is difficult because the anterior capsule is very elastic and the low scleral rigidity results in posterior pressure that keeps the anterior capsule taut. Traditionally high viscosity viscoelastics such as Healon 5<sup>®</sup> have been recommended. Jeng *et al.*, reported a completion rate of 90% with Healon 5<sup>®</sup> and 46.7% with Healon.<sup>[2,3]</sup> Likewise, manual posterior continuous curvilinear capsulorrhexis (PCCC) to prevent posterior capsular opacification is considered to be technically difficult, but remains the gold standard. Dholakia *et al.*,<sup>[4]</sup> reported a 100% completion rate for PCCC with the use of Healon GV. These viscoelastics are however expensive and their routine use is not practical in developing countries. We have been using 2% hydroxypropylmethylcellulose routinely for pediatric cataract surgery in our hospital successfully for many years. We could not find any reports on completion rates with the use of this viscoelastic in a Pubmed search. The following key words were used—completion, pediatric cataract, and capsulorrhexis. Our study aims to study the feasibility of using 2% hydroxypropylmethylcellulose in pediatric cataract surgery.

## Materials and Methods

The completion rates for anterior and posterior capsulorrhexis of three pediatric ophthalmology fellows were reviewed for the year May 2008–May 2009. Only children with congenital/developmental cataracts less than 6 years of age and completing 1 month of postoperative follow-up were included. Patients with microcornea, persistent fetal vasculature, other anterior segment anomalies, partially absorbed cataracts, preoperative posterior capsular dehiscence, fibrotic anterior/posterior capsules, capsular plaques, and zonular weakness were excluded. Traumatic cataracts were included if the cornea was clear and there was no anterior/posterior capsular rupture. The hospital has a fellowship training programme and as a policy, recruits fellows who are adequately experienced in adult cataract surgery (have performed 500 or more small incision cataract surgeries independently). The trainee surgeons had completed six months of preliminary training, including an operation theatre posting for one month where they are allowed to do steps in pediatric cataract surgery for 5-10 cases under supervision of a senior surgeon. The pediatric operation theatre has two operating tables with a senior surgeon (Consultant) operating on the main table and the trainee surgeon on the side table. The operating microscope on the side table is connected to a video monitor, so that the senior surgeon can monitor the progress of the surgery.

A superior scleral tunnel incision made with a 3.2 mm keratome was routinely used. Trypan blue stain was used in all cases. 2% hydroxypropylmethylcellulose was injected and the anterior capsule punctured with a bent 26 G needle. A standard Utrata forceps was used to complete the rhexis. The trainees were advised to pull the capsule towards the center/180 degrees away with frequent regrasping of the edge. Viscoelastic injection was repeated when needed to form the anterior chamber. Should the capsulorrhexis extend, the senior surgeon was called upon to complete the same. 2% hydroxypropylmethylcellulose was injected and an attempt made to recover the rhexis by pulling towards the

center/180 degrees away. Should this fail, the anterior capsule was cut on the other side with Vannas. An attempt was made to complete the capsulorrhexis with the help of a standard Utrata forceps with frequent injections of viscoelastic. If this was not successful, the capsular flap was cut with a Vannas scissors. The trainee surgeon was then allowed to proceed with the remaining steps if deemed fit by the senior surgeon. The operating notes in these cases were written by the senior surgeons.

After aspiration of the soft cortex, 2% hydroxypropylmethylcellulose was used to form the anterior

chamber and a bent 26 G needle used to engage the posterior capsule and initiate the puncture by a gentle sideways and upward (towards the microscope) movement. Viscoelastic was then injected into the anterior chamber. No attempt was made to inject viscoelastic behind the posterior capsule. A standard Utrata forceps was used to complete the rhexis and a sufficient anterior vitrectomy done by an automated vitrectomy machine. Viscoelastic was then used to inflate the bag and an IOL implanted. An injector was used to implant the Acrysof SA60AT IOL. For polymethylmethacrylate (PMMA) IOL's the incision was extended with a keratome to facilitate implantation. The choice between PMMA and Acrysof was largely guided by

**Table 1: Patient details relevant to the study**

SI No.	Age	Type of cataract	Anterior rhexis completion	IOL in bag	Type of IOL	PPC before/ after IOL implantation	PPC completion	Post operative complications
1	4	Traumatic total cataract	Yes	Yes	Acrysof	Before	Yes	No
2	6	Lamellar	Yes	Yes	PMMA	Before	Yes	No
3	5	Lamellar	Yes	Yes	Acrysof	Before	Yes	No
4	3	Lamellar	Yes	Yes	Acrysof	Before	Yes	No
5	6	Total	Yes	Yes	Acrysof	Before	Yes	No
6	4	Total	Yes	Yes	PMMA	Before	Yes	No
7	4	Lamellar	yes	Yes	PMMA	Before	Yes	No
8	4	Lamellar	Extended	Yes	Acrysof	Before	Yes	No
9	3	Traumatic total cataract	Yes	Yes	PMMA	Before	Yes	No
10	3	Traumatic total cataract	Extended	Yes	PMMA	Before	Yes	No
11	6	Total	Yes	Yes	Acrysof	Before	Yes	No
12	2	Lamellar	Yes	Yes	Acrysof	Before	Yes	No
13	2	Traumatic total cataract	Yes	Yes	Acrysof	Before	Yes	No
14	5	Traumatic total cataract	Yes	Yes	Acrysof	Before	Yes	No
15	1.75	Lamellar	Extended	Yes	Acrysof	Before	Yes	No
16	6	Lamellar	Extended	Yes	PMMA	Before	Yes	no
17	4	Total	Extended	sulcus	Acrysof	Before	Yes	No
18	3	Lamellar	Yes	Yes	PMMA	After	Extended	no
19	4	Total	Yes	Yes	PMMA	Before	Yes	no
20	4	Lamellar	Yes	Yes	Acrysof	Before	Yes	No
21	4	Lamellar cataract	Yes	Yes	Acrysof	Before	Yes	No
22	6	Traumatic total cataract	Yes	Yes	Acrysof	Before	Yes	No
23	4	Steroid induced cataract (posterior subcapsular)	Extended	Yes	PMMA	Before	Yes	No
24a	4	Lamellar	Yes	Yes	Acrysof	Before	Yes	No
24b	4	Lamellar	Extended	Yes	Acrysof	Before	Yes	No
25a	4	Lamellar	Yes	Yes	PMMA	Before	Extended	No
25b	4	Lamellar	Yes	sulcus	PMMA	Before	Extended	pupillary capture of IOL
26a	5	Lamellar	Extended	Yes	PMMA	Before	Yes	No
26b	5	Lamellar	Extended	sulcus	PMMA	Before	Yes	No
27a	3	Total	Yes	Yes	Acrysof	Before	Yes	No
27b	4	Lamellar	Yes	Yes	PMMA	Before	Yes	No
28a	5	Lamellar	extended	Yes	PMMA	Before	Yes	No
28b	5	Lamellar	extended	sulcus	PMMA	Before	Yes	No

Serial no. 24 to 28 are bilateral cataracts, PPC: Primary posterior capsulorrhexis, IOL: Intraocular lens, PMMA: Polymethylmethacrylate

the affordability of the patient. Children 2 years or less were provided free Acrysof IOLs from the hospital if they could not afford the same. The trainee surgeons were permitted to do the primary posterior capsulorrhexis (PPC) after the IOL implantation if they so desired. In this case, the IOL was gently nudged sideways to permit insertion of the 26 G needle, and the aforementioned steps followed. The viscoelastic was then removed and the wound sutured. Homatropine 2% was given in the postoperative period to ensure pupil dilatation. The evaluation on the first postoperative day was done by senior surgeons (RM/PV) and a note made on the anterior/posterior capsulorrhexis and IOL centration.

The capsulorrhexis was considered successful when the trainee surgeon was able to complete the same with a smooth edge and without any extension. Capsulorrhexis completed by the senior surgeon was recorded as a failure for purposes of the study.

## Results

33 eyes of 28 children were studied. The relevant patient details are listed in Table 1. Twenty lamellar, six traumatic, six total (developmental) and one steroid induced cataract were included. The age ranged from 1.75 to 6 years with a mean of  $4.1 \pm 1.2$  years. Anterior capsulorrhexis was successfully completed in 22 eyes (66.7%). Rhexis extension occurred in four eyes when the trainee surgeon was negotiating the subincisional region. Extension occurred in the nasal region for one patient. In three eyes, it occurred shortly after starting the capsulorrhexis and the records did not mention extension site for three patients. The senior surgeon could complete the rhexis in 5 eyes by the technique mentioned above. The overall completion rate for anterior capsulorrhexis thus was 81.8%. Posterior capsulorrhexis was completed in 30 eyes (90.9%). The extension occurred in the subincisional area for three cases and could not be completed by the senior surgeon. Posterior capsulorrhexis was done after IOL implantation in only one case. In all other cases, it preceded IOL implantation. No patient had extension of both anterior and posterior capsulorrhexis. An intraocular lens was successfully implanted in the bag in 29 eyes (87.8%). 16 eyes received a PMMA three-piece intraocular lens and 17 eyes had implantation of Acrysof SA60AT IOL. Postoperatively one patient developed pupillary capture of the IOL. No other postoperative complications were noted till the first month follow-up. The posterior capsulorrhexis was judged to be of adequate size and correct position in all patients on slit lamp examination.

## Discussion

Despite the availability of alternative techniques, manual CCC continues to remain the gold standard in pediatric cataract surgery.<sup>[1]</sup> Routine use of high-molecular-weight viscoelastics would however make the cost of surgery prohibitive for developing countries.

Our results show an acceptable completion rate for anterior capsulorrhexis with the use of a low-cost viscoelastic. Jeng *et al.*<sup>[3]</sup> had reported a completion rate of 90% with the use of Healon 5, and a much lower rate with the use of Healon/Viscoat. His patients however were in an older age group (mean

age – 6.4 years). Also all our study patients had been operated upon by trainee surgeons with limited experience in operating pediatric cataracts. It can be expected that the rates would be better for senior surgeons. This is borne out by the fact that senior surgeons could complete anterior capsulorrhexis in an additional five eyes. The extension occurred subincisionally in most cases. This is probably because of shallowing of the anterior chamber when the surgeon pressed on the posterior lip while grasping the flap.

Hamada *et al.*, reported a 100% success in performing anterior and PCCC with the use of the two incision push-pull technique (TIPP). The paper mentions the use of Healon GV.<sup>[5]</sup> We did not use the above technique for our study. It is possible, but remains to be proved that the same can be reproduced with 2% hydroxypropylmethylcellulose if the TIPP is used. Our rate of PCCC completion is somewhat less than that reported by Dholakia *et al.*<sup>[4]</sup> Majority of the IOLs in our series were implanted in the bag, which is in agreement with the studies of Dholakia and Jeng.<sup>[3,4]</sup>

All our surgeons were doing posterior capsulorrhexis for the first time. We restricted our study to trainee surgeons as in many developing countries general ophthalmologists (without formal training in pediatric ophthalmology) provide pediatric eye care.<sup>[6]</sup> The findings thus are of relevance to anterior segment surgeons who want to treat pediatric cataracts and keep the costs low. The information is also of value to pediatric ophthalmology units looking forward to extending their services to underserved areas. The obvious limitation of our study is that we could not compare the results of the same surgeons using hydroxypropylmethylcellulose versus other viscoelastics because of cost reasons. Parameters other than completion rates such as size and position of the rhexis also need to be compared. Further studies are needed to note the experience in operating cataracts with other anterior segment problems such as fibrotic capsules, capsular plaques, and persistent hyperplastic primary vitreous (PHPV).

To summarize, our study shows that it is feasible to perform pediatric cataract surgery with the use of a low-cost viscoelastic without unduly compromising the outcome.

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