

## Changes in central corneal thickness (CCT) in children undergoing cataract surgery: A longitudinal prospective study at a tertiary eye care centre in Kolkata, West Bengal, India

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### Abstract

**Introduction:** Glaucoma is a known cause of visual loss despite successful congenital cataract surgery. The reported prevalence of glaucoma after congenital cataract extraction varies from 1 to 32%. Some authors have reported increased CCTs among children who underwent cataract extraction. Nevertheless, it is unclear whether the increased CCT was present before cataract surgery or developed post-operatively.

**Aims:** To evaluate longitudinal changes in CCT following congenital cataract surgery with and without IOL implantation.

**Settings and Design:** The study was a prospective, longitudinal, observational clinical study.

**Materials and Methods:** A total 30 cataractous eyes of paediatric patients (0 to 16 yrs) were enrolled from the paediatric ophthalmology clinic of our institute. CCT was measured preoperatively in all 30 cataractous eyes, out of which 15 eyes were left aphakic and the rest were made pseudophakic. CCT was measured at 1 month and 3 month post-operative period in both the groups.

**Statistical analysis used:** The data collected was tabulated and analysed following standard statistical protocol using Metlab software.

**Results:** Preoperative CCT values in cataractous eyes were found to tally with the mean CCT of healthy eyes in that same age group. The post-op CCTs after 1 and 3 month were found to be greater than the pre-operative measurements in all the patients. However, it was only in the aphakic group that the increase in CCT was found to be statistically significant. [aphakic p=0.003(1 month),0.004(3 month)]; [pseudophakic p= 0.11(1month),0.06(3 month)].

**Conclusions:** In aphakic eyes, cornea was found to have significantly increased CCTs post-operatively which in turn may influence IOP measurements (false positive results), glaucoma diagnosis, follow-up and treatment.

In pseudophakic eyes, cornea was not found to have significantly increased CCTs post-operatively.

**Keywords:** CCT, Congenital cataract, Aphakia, Pseudophakia, Glaucoma.

**Key message:** IOL implantation after cataract extraction in cases of congenital cataract is not associated with significant increase in CCT post operatively when compared to patients kept aphakic.

### Introduction

The prevalence of glaucoma after congenital cataract surgery varies from 1% to 32%.<sup>(1,2)</sup>

In children since fundus and visual field examination is difficult, IOP measurements becomes the only way to diagnose glaucoma in paediatric age group.<sup>(3)</sup> Central Corneal thickness (CCT) is found to influence IOP measurements. IOP is overestimated with increased CCT, & underestimated with decreased CCT.<sup>(4)</sup> CCT is found higher than average in eyes with aphakic glaucoma.<sup>(5)</sup>

### This Study Aims:

To evaluate whether increased CCT present preoperatively.

To evaluate longitudinal changes in CCT following paediatric cataract surgery in both pseudophakic eyes and aphakic eyes.

### Materials and Methods

Patients in the age group 0 -16 years with congenital and developmental cataract who underwent cataract extraction surgery at our institute were included in the study with the following criteria's

### Inclusion Criteria:

Patient selection criteria were:

Children with visually significant congenital and developmental cataract under 16years of age group attending paediatric ophthalmology clinic at Regional Institute Of Ophthalmology, Kolkata with guardian's informed consent to undergo congenital cataract surgery and follow up after 1 month and 3 month with or without sedation/general anaesthesia according to patient's co-operation.

### Exclusion Criteria:

1. Subjects with signs of developmental glaucoma (i.e, buphthalmos, increased corneal diameter, Haabs striae, etc.)
2. Subjects with a previous history of ocular trauma.
3. Subjects with intraocular laser or surgery other than cataract extraction.
4. Persistent hyperplastic primary vitreous
5. Subjects with aniridia.
6. Subjects with clinically detectable corneal oedema, glaucoma or any systemic disease that influences CCT (eg, Down Syndrome, Marfan Syndrome, sphingolipidosis).

A total 30 cataractous eyes of patients in paediatric age group (0 – 16 yrs.) were enrolled. It was a prospective, longitudinal, observational, clinical study.

For each patient, visual acuity, refractive status, posterior segment evaluation, slit lamp examination to rule out any anterior segment abnormality other than cataract and central corneal thickness measurement were done. CCT measurements were done by ultrasonic pachymeter. Guardian's informed consent for the surgery was taken. All surgeries were performed by a single surgeon.

Post-operative evaluations were done after 1 month and 3 month of cataract surgery with informed guardians consent to undergo general anaesthesia or sedation of the child according to patient's cooperation. The central corneal thickness measurement of the operated eye was done in each visit. The data collected was tabulated and analysed following standard statistical protocol using Metlab software.

### Results and Analysis

In this study patients were chosen arbitrarily so that 15 aphakic & 15 pseudophakic eyes can be taken. Children < 2yrs were left aphakic and children > 2yrs were implanted with primary IOL after their cataract extraction. The age distribution (Table 1), quantitative distribution of preoperative CCT (Table 2), laterality of cataract distribution (Table 3), distribution of laterality in various age groups (Table 4), changes in CCT values post operatively in all patients (Table 5), aphakic patients (Table 6) and pseudophakic patients (Table 7) were analysed.

Out of 16 patients of bilateral paediatric cataract, 5 patients were already operated in one eye. So, the other cataractous eye was only included in the sample for CCT measurement.

**Table 1: Age distribution of patients**

Age in Completed Years	No. of Cataractous Eyes	Percentage
0 – 4	17	56.67%
>4 – 8	7	23.33%
>8 - 12	5	16.67%
>12	1	3.33%
Total	30	100%

**Table 2: Quantitative distribution of preoperative CCT**

Preoperative CCT(In $\mu\text{m}$ )	No of Cataractous Eyes	Percentage
450 - 500	3	10%
>500 - 550	9	30%
>550 - 600	14	46.66%
>600 - 650	2	6.67%
>650	2	6.67%
Total	30	100%

**Table 3: Laterality of cataract distribution**

Laterality	No of Patients	Percentage
Unilateral	3	15.79%
Bilateral	16	84.21%
Total	19	100%

**Table 4: Distribution of laterality in various age groups**

Age Groups	No of Unilateral	No of Bilateral
0 Yr-4 Yr	2	8
>4 Yr-8 Yr	0	4
>8 Yr-12 Yr	1	3
>12 Yr	0	1
Total	3	16

**Table 5: Changes in CCT values post operatively in all the patients (p value for 1 month 0.00079 and 3 months 0.00098)**

	Pre-Operative	1 Month Post-Operative	3 Month Post-Operative
Mean CCT	559.73 $\mu\text{m}$	573.3 $\mu\text{m}$	570.06 $\mu\text{m}$
Standard Deviation	46.45	43.02	46.08

**Table 6: Changes in CCT values post operatively in aphakic patients (p value for 1 month 0.00308, for 3 months 0.00353)**

	Pre-Operative	1 Month Post-Operative	3 Month Post-Operative
Mean CCT	566.53 $\mu\text{m}$	583.47 $\mu\text{m}$	582.47 $\mu\text{m}$
Standard Deviation	62.31	56.52	59.08

**Table 7: Changes in CCT values post operatively in pseudophakic patients (p value for 1 month 0.11377, 3 months 0.05836)**

	Pre-Operative	1 Month Post-Operative	3 Month Post-Operative
Mean CCT	553.93 $\mu\text{m}$	562.47 $\mu\text{m}$	557.67 $\mu\text{m}$
Standard Deviation	22.70	19.50	24.05

### Discussion

The present study was undertaken to assess the presence of increased central corneal thickness pre-operatively and post-operatively after 1 month and 3 month of paediatric cataract surgery. A total 30 cataractous eye of patients in paediatric age group (0 – 16 yrs) were enrolled from our institute.

The study population included 17 males and 2 females with male: female ratio 9:1; thus the no of males

in the study population was more than the females like in Danish Study.<sup>(6)</sup> This may be due to the increased incidence of congenital and developmental cataract in males. However, in our country this might reflect the social malady of neglecting the needs of a girl child for which they tend to attend less in hospital hence not reflecting the true picture i.e. an example of Berksonian Bias.<sup>(7)</sup>

In this study, arbitrarily patients were chosen so that 15 aphakic and 15 pseudophakic eye can be taken. Children with <2 years were left aphakic primarily. Remaining 15 eyes underwent primary foldable PCIOL implantation with or without primary posterior capsulorhexis and anterior vitrectomy. All 30 cataractous eyes underwent uneventful cataract surgery. So, in the results; majority of the cataracts were found in 0-4 years followed by >4-8 years.

There were no significant changes in CCT value found post operatively after 1 month and 3 month in pseudophakics with PCCC (p value for 1 month 0.148, p value for 3 month 0.268) and in pseudophakics without PCCC (p value for 1 month 0.477, p value for 3 month 0.152).

Out of 30 cataractous eyes, 16 patients were found to have bilateral cataracts and 3 patients had unilateral cataracts. This was in accordance with an epidemiological based etiological study of paediatric cataract in western India by Vasavada et al.<sup>(8)</sup> which found out the ratio of unilateral paediatric cataract to bilateral paediatric cataract to be 36:116.

Maximum no of pre-operative cataractous eyes were found to have CCT in the range of >550 – 600 µm followed by >500 – 550 µm. This tallies with average CCT of healthy eyes in children i.e. 540 – 560 µm. Again in a study of Dai E et al. the reported range for the CCT of children was within (529 ± 34 µm to 555 ± 42 µm).<sup>(9)</sup>

### Mean Pre-Operative CCT

GENERAL	: 560 µm
APHAKEIC	: 567 µm
PSEUDOPHAKIC	: 554 µm

The above is in accordance with Muir et al. (10) where children with congenital cataract were analysed and no significant difference was observed with controls.

The mean CCT in general (taking both aphakic and pseudophakic) 1 month post-operatively was found to increase from mean pre-operative CCT and was statistically significant with paired t-Test.

Similarly, mean CCT in generals post-operatively after 3 months found to increase from mean pre-operative CCT and was statistically significant too by paired t-Test.

The above findings corroborates with Kelly W. Muir et al.<sup>(11)</sup> where pseudophakic and aphakic eyes of children demonstrated thicker CCT than normal eyes and eyes with cataracts (before surgery).

The mean CCT in aphakic eyes post-operatively after one month and post-operative 3 months was found to get increased from pre-operative mean CCT of the cataractous eyes. Paired t-test was applied to know the significance of the changes and was found to be statistically significant.

Above finding simply supports an earlier report with Simon JW et al.<sup>(12)</sup> that found a significantly increased CCT in a group of 28 aphakic patients.

In pseudophakic eyes, the mean CCT post-operatively after 1 month and post-operatively after 3 months was too found to get increased from pre-operative cataractous eyes. Paired t-test was applied to know the significance and the change was statistically not significant.

This finding collaborates with Kelly W. Muir et al.<sup>(11)</sup> where it was found that the mean CCT of the pseudophakic eyes of the paediatric cataract was greater than the control eye and was not statistically greater than that of eyes with cataract (p=0.06).

In aphakia, 1 month and 3 month post-operatively mean CCT value was found greater than mean CCT's in pseudophakia.

The findings tally with Kelly W. Muir et al.<sup>(11)</sup> where CCT of aphakic eye was found greater than pseudophakic eye.

Increased CCT after congenital cataract extraction has no clear explanation. Some say that vitreous may have access to the anterior chamber, changing its physiological components<sup>(1,13)</sup> may influence the normal corneal development and affect CCT<sup>(14)</sup> The developing cornea may be harmed by the surgical trauma.<sup>(15,16,17)</sup>

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