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Original Research Paper

Ophthalmology

CENTRAL CORNEAL THICKNESS FOLLOWING CATARACT SURGERY IN PEDIATRIC PATIENTS

Dr.G.Sujatha Assistant Professor of Ophthalmology, SDEH, Hyd.

Dr.R.Prameela* Assistant Professor of Ophthalmology, SDEH,Hyd *Corresponding Author

Dr.Geethika post graduate, SDEH, Hyd

ABSTRACT

Introduction- Childhood Cataract blindness is one of the major avoidable causes of blindness in both developed and developing countries and it is a priority for VISION 2020: The right to sight. Cataracts are reported to be responsible for approximately 20% Of cases of childhood blindness globally. Children with congenital cataracts in the developing world often go untreated for several years unlike in developed countries where they are treated within few months of birth. Lack of awareness, access and monetary resources deprive many blind children of corrective surgery. Their blindness profoundly limits their prospects for education, social integration and eventual employment. Of the 1.4 million blind children globally, the number due to lens-related conditions is estimated to 190,000 (14%). the earlier the cataract is removed and visual rehabilitation is started, the lesser the chances of amblyopia setting in. The goal of the present study was to measure the CCT changes before and after uncomplicated surgery minimal manual clear corneal incision with irrigation and aspiration and IOL implantation in a congenital and developmental cataract case. It looks at the changes taking place in CCT on 1st post-operative day, 1st week, 1st month, 3rd month and 6th month following the cataract surgery in children of the age group 6years to 14 years at a tertiary eye care centre in Telangana.

Aim To evaluate central corneal thickness (CCT) changes before and after uncomplicated congenital and developmental cataract surgery in pediatric patients between 6-14 years of age.

Design- Prospective interventional case study

Material and methods This study done in pediatric and squint ophthalmic out-patient department at Sarojini Devi Eye Hospital, Hyderabad, Telangana, from November 2015- October 2017. The study group included 80 clinically diagnosed eyes of 50 children with 20 unilateral and 30 bilateral congenital cataracts presenting at the age of 6-14 years. Data of patient's age, sex, detailed history with regard to onset of cataract and visual difficulties, and family history are noted. All the eyes underwent complete slit lamp examination, fundus examination and subjective refraction, B scan and the CCT changes measured with specular microscopy in all cases preoperatively and postoperatively on 1st day, 1st week, 1st month, 3rd month and 6th month. Manual clear corneal incision (minimal incision cataract surgery) with lens matter removal by irrigation and aspiration and IOL implantation done. All the data was recorded and presented as mean. The p-value is calculated using the one sample t-test used on all continuous data to calculate statistically significant difference between pre-operative and post-operative values in same group. The statistical significance difference is taken when p-value <0.05.

Results – The study evaluated 80 eyes of 50 children with 20 unilateral and 30 bilateral congenital cataracts presenting in late childhood of age 6- 14 years which were clinically diagnosed. It was observed that 23 (46%) male and 27 (54%) female were found to have congenital cataract. Age wise, before 10year males- 17 (73.91%) and after 10yr in male- 6 (26.08%), before 10yr female- 16 (59.25%) and after 10year female- 11 (40.74%). The mean CCT before cataract surgery was 533± 25, and the observations of changes in CCT were as follows 1st day – 560±20, after 1st week 550±20, after 1 month 534±25, after 3 month 540±30, and after 6 months 539±30. The preoperative mean endothelial cell count for the entire sample was 2523 cells/mm^2 and reduced at 6th month post operatively to 2385 cells/mm^2. ECL found at 3 months after surgery was (4.43%) and at 6 months after surgery was 1.36% (4.43%-5.79%).

Conclusion Clear corneal incision with manual irrigation and aspiration provides important benefits of faster visual recovery, shorter surgical time, cost effective and less manipulation and proves to be the safest procedure to be adopted for congenital cataract surgery.

KEYWORDS : Central corneal thickness (CCT), Endothelial cell loss (ECL), Specular Microscopy

INTRODUCTION

Cataract surgery is the most commonly performed intraocular surgery in the pediatric population. Although there has been great improvement in the instrumentation, microsurgical techniques and handling of the pediatric eyes, this procedure still appears to be stressful to the intraocular tissues. The corneal monolayer of endothelial cells lack the ability to regenerate,[1] and can be reduced by outside stressors such as physical trauma caused by surgery,[2] intraocular lens contact,[3,4] and toxicity of surgical solutions and drugs.[5,6] An increased propensity for postoperative inflammation[7] and glaucoma[8,9] also exists in pediatric eyes. These complications can be deleterious to the corneal endothelium as well. Changes in the endothelial cells are believed to affect the corneal thickness. Even if the vision is not altered, increased thickness may cause alteration in the accurate intra-ocular pressure assessment.[10,11]

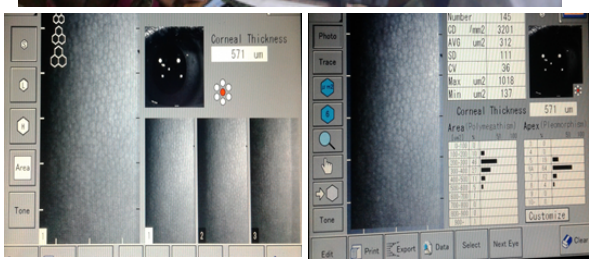
Previous studies have reported ECL following pediatric cataract surgery, with cell loss rates ranging from 0-9.2 % with lens removal by anterior approach.[2, 16-20] As the corneal endothelium functions to maintain corneal clarity by decreasing corneal water content, ECL or dysfunction has been associated with corneal edema and increased CCT.

MATERIAL AND METHODS

This study done in pediatric and squint ophthalmic out-patient department at Sarojini Devi Eye Hospital, Hyderabad, Telangana, from November 2015- October 2017. The study group included 80 clinically diagnosed eyes of 50 children with 20 unilateral and 30 bilateral congenital cataracts presenting at the age of 6-14 years. Data of patient's age, sex, detailed history with regard to onset of cataract and visual difficulties, and family history are noted. All the eyes underwent complete slit lamp examination, fundus examination and subjective refraction, B scan and the CCT changes measured with specular microscopy in all cases preoperatively and postoperatively on 1st day, 1st week, 1st month, 3rd month and 6th month. noncontact specular microscopy used for measuring

corneal thickness and endothelial cell density. Manual clear corneal incision (minimal incision cataract surgery) with lens matter removal by irrigation and aspiration and IOL implantation done. All the data was recorded and presented as mean. The p-value is calculated using the one sample t-test used on all continuous data to calculate statistically significant difference between pre-operative and post-operative values in same group. The statistical significance difference is taken when p-value <0.05.

Tomey EM-3000 All-in-one Specular Microscope



EVALUATION OF A CHILD WITH CATARACT

INCLUSION CRITERIA

80 eyes of 50 children with 20 unilateral and 30 bilateral congenital cataracts presenting in late childhood are included.
Age 6-14 years.

EXCLUSION CRITERIA

Traumatic cataracts
Complicated cataracts.
patients with a history of, or currently active, inflammatory process within the eyeball (with the exception of conjunctivitis);
patients with a history of surgery;
patients with associated ocular diseases;
patients with general diseases.
Patients with intra operative complications like vitreous loss and iris prolapse.

Prospective interventional case study,
Study duration – November 2015 – October 2017,

BIOMETRY: This is done to calculate IOL power. It is calculated using the SRK formula and under correction is done based on the age of the child cataract.

PREPARATION FOR SURGERY: All the children are operated under general
anesthesia, atropine sulfate 1% eye ointment should be used 3 times the day
before surgery for obtaining maximum pupillary dilatation.

SURGICAL TECHNIQUE[18,19,20]

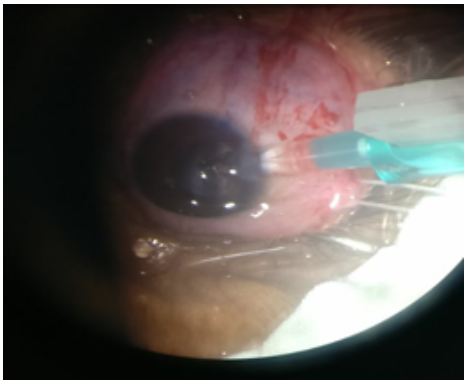
Rectus suture and conjunctival flap: is taken and lid speculum is placed.

INCISION: A clear corneal incision of 3mm-3.2mm is made with a blade. The anterior chamber is entered with a 3.2mm keratome, viscoelastic is injected to maintain the anterior chamber.

3. Anterior capsulotomy: Continuous curvilinear capsulorrhexis (CCC) is preferred. This ensures in the bag placement of the IOL. Trypan blue is used to stain the anterior capsule for better visualization during capsulorrhexis, also reduces the elasticity of the capsule.

5. Irrigation and Aspiration: done manually with simcoe cannula.

6. Foldable PCIOL Implantation: In children >1 year, in the bag placement is preferred.



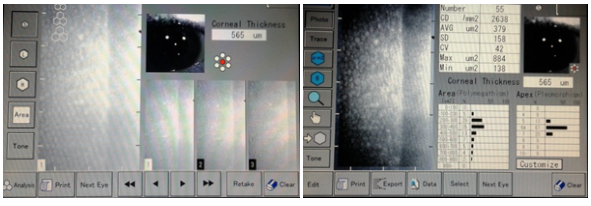
7. Closure. The viscoelastic is aspirated and replaced with saline. The superior rectus bridle suture is removed. Incision sutured with 10-0 Nylon and sub conjunctival gentamicin and dexamethasone injection is given.

Finally, the eye speculum is removed and a pad and bandage is applied.

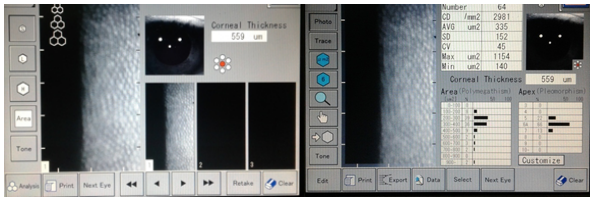
POST OPERATIVE TREATMENT hourly topical steroid eye drops that are gradually tapered in the next 4-6 weeks. Topical cycloplegics are administered twice daily for two weeks. Oral steroids are started on the 1st postoperative day and tapered over 4-6 Week.

Pre-operative CCT image

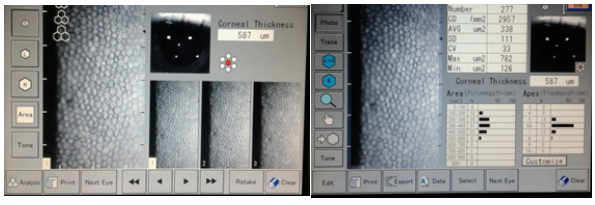
1st post-operative day CCT image



Pre-operative CCT image



1st post-operative day CCT image



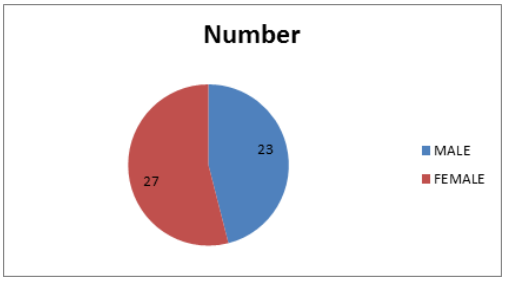
RESULTS:

The present study of CCT changes following cataract surgery during pre and post-operative periods in children attending pediatric department was undertaken from October 2015 to November 2017 in Sarojini Devi Eye hospital, Hyderabad, Telangana. 50 patients both male and female were evaluated to establish the diagnosis and were operated for improvement of visual function and also observed for the post-operative CCT, the results are tabulated.

TABLE – 1

Sex distribution

SEX	Number
MALE	23
FEMALE	27

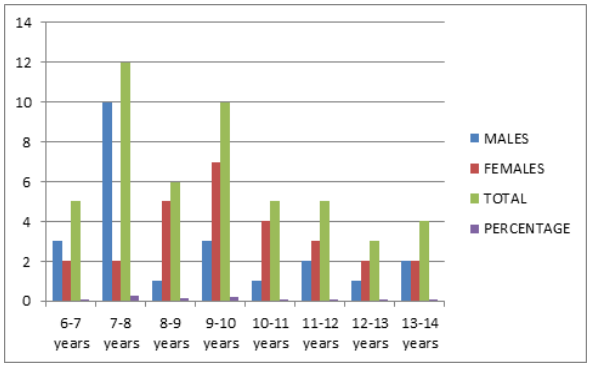


It was observed that 23 male (46%) and 27 females (54%) were found to have congenital and developmental cataract. There is slight female preponderance in the study.

TABLE – 2

Age Wise Distribution of Cataract in Female and Male Children

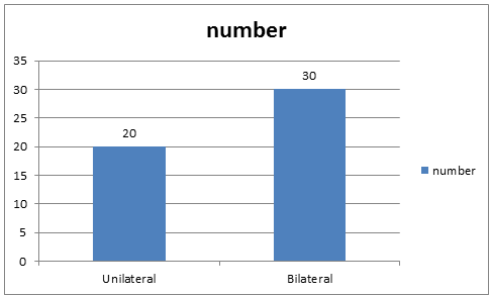
AGE WISE IN YEARS	MALES	FEMALES	TOTAL	PERCENTAGE
6-7 years	3	2	5	10%
7-8 years	10	2	12	24%
8-9 years	1	5	6	12%
9-10 years	3	7	10	20%
10-11 years	1	4	5	10%
11-12 years	2	3	5	10%
12-13 years	1	2	3	6%
13-14 years	2	2	4	8%



Maximum number of cataracts were observed between 7-8 yrs, 10 cases in male children and in females between 9-10 yrs, 7 cases. If it is broadly divided into before 10 yr and after 10yr in male children 17(73.91%) cases and 6(26.08%) cases were recorded in female children 16(59.25%) cases were recorded before 10 yr and 11(40.74%) cases after 10 yr. The incidence of cataract was more before 10 yr in male children and after 10 yr in female children.

TABLE - 3 Presentation of cataract Unilateral vs Bilateral

Cataract	Number
Unilateral	20
Bilateral	30

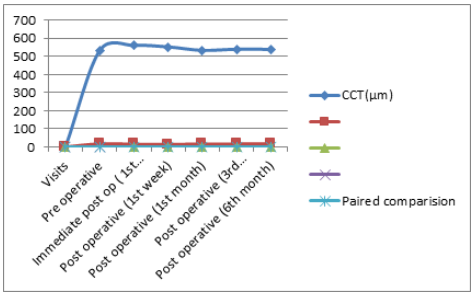


Unilateral was found in 20 cases (40%) and bilateral in 30 cases (60%).

TABLE - 4

Comparison of CCT (µm) in 50 eyes (before and after surgery)

Visits	CCT (µm)				Paired comparison
	Mean	SD	CCT increase	P-value	P-value(95%CI)
Pre-operative	533.2	17.11		0.0102	-
Immediate post op (1st day)	561.44	14.65	28µm		Baseline vs 1st post op day P<0.0001
Post-operative (1st week)	553.34	14.23	20 µm		Baseline vs 1 st week P<0.0001
Post-operative (1st month)	534.14	15.33	1 µm		Baseline vs 1st month P= 0.007
Post-operative (3rd month)	540.5	16.23	7µm		Baseline vs 3rd month P= 0.0069
Post-operative (6th month)	539.76	16.16	6µm		Baseline vs 6th month P=0.0102



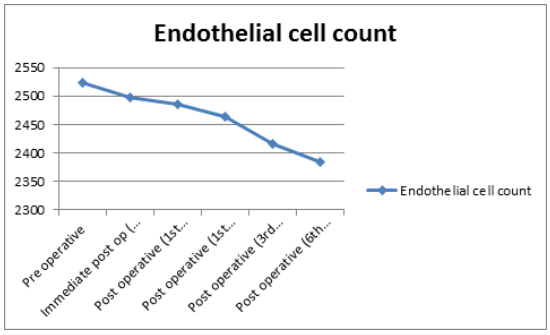
The above table shows the comparison of CCT values before and up to 6 months after surgery. The overall mean difference of CCT was seen statistically significant before and after surgery, up to 1 month and later became insignificant (p=0.0102). The mean difference of CCT at 1 week was very significant and at 1 month postoperative was insignificant as compared with baseline (p=0.007). The1st post-operative day,1st week ,1st month and 3rd month post-operative means were also significantly higher than baseline CCT mean.

The above figure shows the postoperative percentage of mean CCT increase on 6 follow up visits.

TABLE – 5

Assessment of Mean Endothelial cell count

	Endothelial cell count(cell/mm^2)
Pre-operative	2523
Immediate post op (1st day)	2498
Post-operative (1st week)	2486
Post-operative (1st month)	2463
Post-operative (3rd month)	2416
Post-operative (6th month)	2385



The preoperative mean cell count for the entire sample was 2523 reduced at 6th month post operatively to 2385. The maximum ECL was found during first 3 months after surgery. An average 10.5% reduction in cell count was recorded by 6th month post operatively.

DISCUSSION

Congenital cataracts are responsible for nearly 10% of all vision loss in children worldwide. Timely intervention is of great importance in achieving favorable visual outcomes in these patients. Congenital cataracts are one of the most common treatable causes of visual impairment and blindness in children.

The objective of this study was to evaluate mean changes in CCT after cataract surgery with manual irrigation and aspiration of lens matter and foldable intra ocular lens (IOL) implantation using clear corneal incision in patients presenting with congenital and developmental cataract.

In present study, 50 cases with congenital cataract were studied over a period of 2 years from October 2015 to November 2017 in age group of 6-14 years. 50 cases who had uneventful clear corneal incision cataract surgery with manual irrigation and aspiration and foldable PCIOL implantation were prospectively evaluated for CCT measurements.

There is slight female preponderance in the present study as shown in (Table-1).

The incidence of cataract was more in male before 10 years and in female after 10 years (Table2).

Analysis of 50 cases, unilateral cataract was found in 20 cases (40%) and bilateral in 30 cases (60%) (Table-3).

The mean CCT before cataract surgery was 533± 25, and the observations of changes in CCT were: 1st day – 560±20, after 1st week 550±20, after 1 month 534±25, after 3 month 540±30, after 6 months 539±30 (Table-4).

The increase in CCT after cataract surgery appears to be due to corneal edema, which settles over 4 weeks after surgery.

Vasavada et al.,[21] studied 100 eyes of children with congenital cataracts in which CCT was measured before cataract surgery, after implantation of an artificial lens, and 3 months following surgery. Before surgery, mean CCT was 529 ± 30; 3 months after surgery it was 527 ± 34.

The result obtained by this study is, mean CCT before cataract surgery was 533± 25, and the observations of changes in CCT were as follows 1st day – 560±20, after 1st week 550±20, after 1 month 534±25, after 3 month 540±30, and after 6 months 539±30.

The initial preoperative mean cell count for entire sample was 2523 cells/mm^2 reduced at 6th month post operatively to 2385 cells/mm^2.

In the present study, maximum ECL was found upto first 3 months after surgery (4.43%) and then the rate of cell loss reduced. There

was further reduction of only 1.36% (4.43%-5.79%) from 3 months to 6 months post-operatively (Table 5)

According to a recent study by Vasavada et al.,[22] he reported that 3 months after cataract surgery with simultaneous implantation of a lens, that the incidence of corneal ECL was 5.1% in children.

According to Koraszewska-Matuszewska et al.,[23] the average loss of endothelial cells in children six months after extracapsular congenital cataract surgery was ranged from 8% to 27.8% with the mean loss was 11.2%.

This study results suggest that postoperative endothelial cell density and CCT are different from pre-operative values. The ECL in present study was 4.43% at 3 months and 5.79% at 6 months after surgery. The percentage of ECL after pediatric cataract surgery has reduced as compared to the data reported during last few decades.

Urban and colleagues observed mean ECL of about 10.94% after 1 month, 17.85% after 6 months and 22.68% after 12 months of ECCE with polymethacrylate (PMA) IOL implanted through corneal incision. This significantly high rate of cell loss in their study is probably due to different site of incision and different surgical technique from recently used closed chamber technique.

This data is comparable with the work done by Basti [24] and coworkers. They found the mean ECL of about 5.28% 24 - 36 weeks after ECCE and capsular bag IOL implantation through scleral tunnel incision. The present study showed comparable ECL of 5.05%, 24 weeks after surgery.

Comparisons between corneal thickness and endothelial damage by means of specular microscopy have in the past shown a good correlation between the increased cell loss and early postoperative increase in corneal thickness. Measurement of corneal thickness is a more readily available method and may in some ways be a better overall indicator of endothelial cell damage than counting endothelial cells over a very small area of the cornea. A peak in corneal thickness at 24 hours has been noted previously, but measurements prior to 24 hours have not been recorded by other workers.

Thus, the authors believe that surgical trauma is an important factor responsible for the postoperative changes in CCT and ECL.

It is a well-known fact that the corneas of young children must stay clear for longer period of time and it is important to practice great care during cataract surgery to lessen endothelial cell loss.

To date, there has been only a very small number of reports providing information on the CCT changes and loss of endothelial cells post operatively in children.

All the Authors like Liesang et al.,[25] Bourne et al.,[26,27] Galin et al.,[28] and Lin et al., agree that the greatest loss of endothelial cells occurs in the early postoperative period. A large loss of endothelial cells has been associated with the material from which the lenses have been made. As the knowledge of medical science has been advanced, the material from which lens are manufactured has improved, leading to better clinical results.

It is therefore recommended that conscious and adequate measures should be taken to reduce manipulation on the cornea during cataract surgery in order to achieve relatively reduced CCT changes and endothelial cell loss with immediate postoperative patient's satisfaction, and to improve patient's vision and quality of life.

CONCLUSION

The present study demonstrates that in eyes with congenital and developmental cataracts, surgery using clear corneal incision and manual irrigation and aspiration, there was a transient increase in corneal thickness following cataract surgery with subsequent decrease to preoperative thickness by 3rd o 6th months post-surgery with no significant decrease in corneal clarity.

Thus, clear corneal incision with manual irrigation and aspiration seem to be very appealing because of the important benefits of faster visual recovery, shorter surgical time, cost effective and less manipulation and proves to be the safest procedure to be adopted for congenital cataract surgery.

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