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A Clinico Imaging Correlation between Central Corneal Thickness with Cup Disc Ratio, Retinal Nerve Fibre Layer Thickness in Glaucoma

Arvind Kumar[1], Mayank Shrivastava[2], Satya Prakash Singh[3], Santosh Kumar[4], Jagrati Rana[5]

Abstract

Aim: To assess the CCT and its relationship with cup disc ratio and RNFL thickness in POAG and PACG patients. *Design:* Prospective observational study. *Material and Method:* This study was carried out at the Regional Institute of M.L.N. Medical College and Hospital Prayagraj from December 2018 to November 2019. A total of 43 eyes, 17(29 eyes) patients of POAG , 8 (14 eyes) patients of PACG included. Measurement of CCT done by Specular Microscope and (RNFL) thickness evaluated by OCT. *Results:* In thinner cornea group (450–500 µm) CCT is more positively correlated with RNFL thickness in both PACG (r = 0.420) and PAOG (r = 0.451) patients. CCT and CD ratio was more negatively correlated in PACG patient (r = –0.652) for vertical and (r = –0.907) for horizontal CD ratio than in PAOG patients (vertical CD ratio r = –0.018 and horizontal r = –0.022). In thicker cornea group i.e. 501–550 µm average RNFL thickness was more positively correlated with the CCT variation in POAG (r = 0.448) than in PACG (r = 0.219). CCT was more negative correlated with cup disc ratio in PAOG group (r = –0.447) than in PACG group (r = –0.104) of patients. *Conclusion:* In thinner cornea group (450–500 µm) there is a definite positive correlation between CCT and RNFL thickness. Both average and quadrantric RNFL thickness was more pronounced in PACG Group as compared to POAG group. However in thicker Cornea (501–550µm) group CCT is more positively correlated with RNFL loss in POAG as compared to PACG group. Also POAG group exhibited more rapid increase in cup disc ratio with thinning of cornea.

Keywords: (CCT) Central corneal thickness; (RNFL) Retinal nerve fiber layer; (POAG) Primary open angle glaucoma; (PACG) Primary angle closer glaucoma.

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Introduction

Glaucoma is a chronic, progressive optic neuropathy caused by group of ocular conditions, which lead to damage of the optic nerve with loss of visual function.[3] Glaucoma is the leading cause of irreversible blindness globally and accounts for about 10% of all blindness worldwide and Asia alone accounts for 60% of this number. Reports indicate that the glaucoma population will increase from 60.5 million in 2010 to 80 million people up to 2020 and to approximately 111.8 million by the year 2040.[1,2] Though primary open angle glaucoma (POAG) is more common worldwide, but the incidence of blindness is higher with primary angle closure (PACG) glaucoma.

In India, at least 12 million people affected and nearly 1.2 million people blind from the disease. Screening of glaucoma is challenging, as there is no single parameter or test with high sensitivity and specificity and disease is usually asymptomatic until the advanced stages and so actual burden of disease prevalence is hidden , so early detection and treatment of glaucoma are essential to prevent the vision loss.[3]

The role of central corneal thickness (CCT) measurement in the clinical evaluation of glaucoma is well established by many previous studies. Also the effect of CCT is directly related to the

Author Affiliation: [1]JR-3, [2]Professor, [3]Principal and Director, [4,5]Associate Professor, Department of Ophthalmology, M.L.N. Medical College, R.I.O., Prayagraj, India.

Corresponding Author: Arvind Kumar, JR-3, Department of Ophthalmology, M.L.N. Medical College, R.I.O., Prayagraj, India.

E-mail: arvind.dr.2medicine@gmail.com

measurement of intraocular pressure (IOP), the only modifiable risk factor in the treatment of glaucoma which play a important role in deciding the management of glaucoma patients.[4] Thus, evaluation CCT is an important component of a complete ocular examination in glaucoma, particularly for patients being evaluated for the risk of developing POAG.

Glaucoma causes progressive thinning of retinal nerve fiber layer (RNFL) thus evaluation of the it has a potential clinical value, thinning can occur before irreversible functional visual field loss. OCT is an effective means of quantifying the retinal nerve fiber layer.

The current study is undertaken to explore the variation of central corneal thickness (CCT) and its correlation with RNFL thickness and optic disc parameters i.e. cup to disc ratio in PACG and PAOG patients.

Material and Methods

Study was carried out at the Regional Institute of Ophthalmology (M.D. eye Hospital, Dr. Katju Road, Nakhas Kona, Prayagraj) after taking permission from ethical committee of M.L.N. Medical College Prayagraj from December 2018 to November 2019.

Study Design

This was a prospective observational study. We included total of 17 (29 eyes) patients of POAG , 8 (14 eyes) patients of primary PACG . There were 15 (40%) male and 10 (60%) female subjects with mean age of 36.62 years (SD=7.31) in PACG and 51.58 years (SD=16.70) POAG group.

Selection of Cases

Inclusion Criteria: Diagnosed case of POAG and PACG were included in this study.

Exclusion Criteria: We excluded the glaucoma types other than the POAG and PACG ,Patients having corneal pathology or surgery that might influence CCT measurement, cataract surgery,Contact lens user subjects which might influence central corneal thickness measurement .

All subjects underwent baseline evaluation as complete systemic examination, detailed medical history and history of visual disturbance with duration, progression and associated complaints. History of anti-glaucoma drugs were also taken. Following examinations had been done to evaluate the patients.

1. General examination.
2. Ocular Examination
   a. Best corrected Visual Acuity
   b. Slit Lamp Biomicroscopy including gonioscopy.
   c. IOP measurement have been done by Schiotz tonometer
   d. All the patients undergone dilated fundus examination.
   e. Visual field examinations was performed in all patients in which vision permitted and being performed by Oculus Twinfield Version 3.18r 925 using 24–2 Swedish Interactive Threshold Algorithm (SITA).
   f. Measurement of CCT was done by Specular Microscope Topcon SP-1P Version 1–41. RNFL thickness was evaluated by Cirrus HD-OCT (Software version 6.5.0.772; Zeiss Meditec).

Patients were followed within 3 month of presentation and further evaluation of CCT and disc parameters with RNFL have been done.

Observation and Result

We included a total of 25 patients with 43 eyes for the study. Out of which 29 eyes of PAOG and 14 eyes with PACG were taken. There were 15 (40%) male and 10 (60%) female subjects with mean age of 36.62 years (SD=7.31) in PACG and 51.58 years (SD=16.70) POAG group.

All the patients were divided into two groups for the comparison ,one between CCT 450–500 µm and second between CCT 501–550 µm. In both group we have done OCT-ONH and evaluated average and quadrantic RNFL thickness.

To assess the correlation between CCT and RNFL thickness we calculated Pearson correlation coefficient for each quadrant and also for average RNFL thickness.

Table 1: Showing RNFL thickness in patients with CCT 450–500 µm.

RNFL Thickness	PACG	PAOG	R value	
			PACG	PAOG
Average	25.56±7.93	48.31±33.27	0.357	0.240
Inferior	21.33±28.01	63.77±47.73	0.420	0.226
Superior	26.44±28.59	50.18±44.35	0.386	0.218
Nasal	34.78±20.02	38.81±28.65	0.170	0.457
Temporal	24.67±29.78	41.18±29.67	0.288	0.277

r= pearson correlation coefficient

We found positive correlation between CCT and RNFL thickness in all quadrant and also for average RNFL thickness. The average RNFL thickness was found more positively correlated with CCT in PACG patients than POAG patients.

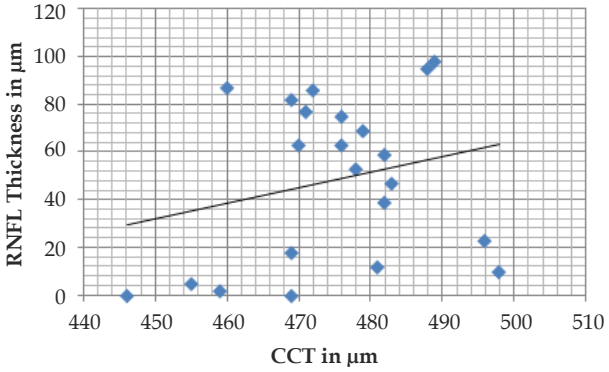

Fig. 1: Showing correlation of CCT variation with average RNFL thickness in PAOG patients with CCT 450–500 µm and pearson correlation coefficient r=0.240 i.e. positive linear relationship.

In thicker cornea group (501–550 µm) we found that average and quadrantic RNFL thickness was more positively correlated with the CCT in POAG than in PACG group of patients.

Table 2: RNFL Thickness in patients with CCT 501–550 µm.

RNFL Thickness	PACG	PAOG	Pearson correlation=r	
			PACG	PAOG
Average	56.40±17.53	51.57±24.56	–0.291	–0.448
Inferior	65.00±56.34	46.71±35.49	–0.167	–0.816
Superior	57.20±13.22	69.28±33.96	–0.027	–0.246
Nasal	45.60±05.81	48.85±21.91	–0.189	–0.166
Temporal	57.60±20.24	41.71±18.06	–0.222	–0.215

We also evaluated cup disc ratio in both groups of patients and calculated mean and standard deviation for both vertical and horizontal meridian.

Table 3: Showing cup disc ratio and Pearson correlation coefficient for vertical/horizontal both.

CCT group 450–500 µm	PACG	PAOG
Cup disc ratio vertical/horizontal	0.77±0.26/0.83±0.06	0.65±0.15/0.67±0.13
Pearson correlation coefficient vertical/horizontal	–0.652/–0.652	–0.181/–0.022
CCT group 501–550 µm		
Cup disc ratio vertical/horizontal	0.56±0.19/0.60±0.15	0.68±0.18/0.71±0.18
Pearson correlation coefficient vertical/horizontal	–0.097/–0.123	–0.104/–0.447

We found that cup to disc ratio was negatively correlate with CCT for both in vertical and horizontal meridian in both group of patients.

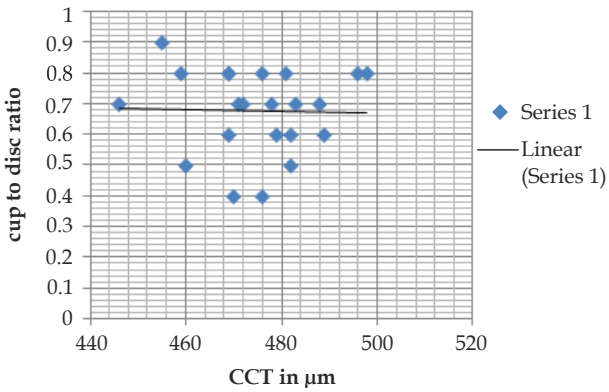

Fig. 2: Showing correlation between CCT and horizontal cup to disc ratio in (CCT)450 –500 µm. with Pearson correlation coefficient r= –0.022 i.e. negative correlation in PAOG patient.

From the above mentioned scatter graphical presentation and Pearson correlation coefficients we can see that in CCT group 450–500 there is more negative correlation between CCT and cup disc ratio in PACG group of patients than in PAOG group of patients.

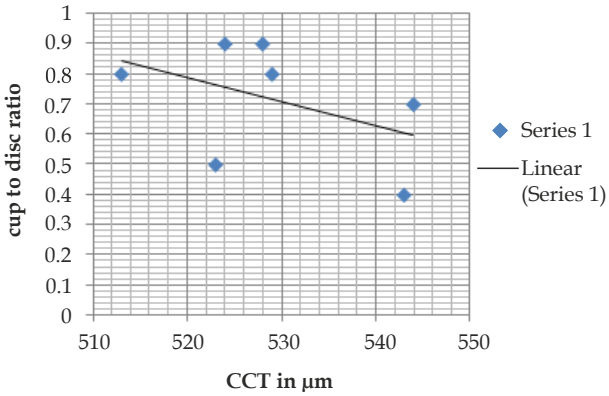

Fig. 3: Showing correlation between CCT and horizontal cup to disc ratio in (CCT)501 –550 µm. with Pearson correlation coefficient r= –0.447 i.e. negative correlation in PAOG patient.

On the other hand from the above mentioned scatter graphical presentation and Pearson correlation coefficients we can see that in CCT group 501–550 there is more negative correlation between between CCT and cup disc ratio in PAOG group of patients than in PACG group of patients.

Discussion

Patients presented were all diagnosed cases of POAG and PACG on treatment. In our study most of the patients of PACG were of younger age group and with advanced glaucomatous changes at the time of inclusion in our study.

It has previously been demonstrated by many authors that optic nerve head changes and nerve

RNFL thickness may occur earlier than visual field changes. In glaucoma patients, study of RNFL thickness exhibited that mean RNFL thickness differed significantly with the progression of disease.

We found that CCT is correlated significantly with all the RNFL thickness parameters in both subtypes of glaucoma i.e. POAG and PACG. Results of correlation between CCT the RNFL thickness showed that Pearson correlation coefficient is positive in all quadrants and also for average RNFL thickness in both groups of glaucoma and positively correlated i.e. with the decrease of CCT and RNFL thickness also decreases.

We observed that in also noticed that in thinner cornea group (450–500 μm) there is significant thinning of both average and quadrantic RNFL and it is more pronounced in PACG group showed (r=0.357) than in POAG group of patients (r = 0.240). These findings are in accordance with the previous studies reported by Boonchai Wang Supadilok et al 2014[11] that there is moderate positive correlation between CCT and RNFL thickness in POAG patients. Though they only included POAG patients. Sushmit Kaushik et al 2005[5] compared three RNFL parameters as average, superior, inferior quadrants in ocular hypertensive and normal control group subjects and found that CCT correlated significantly with all RNFL thickness parameters in ocular hypertensives and correlated positively. Hyuk Jin choi et al 2006[7] also found that there is relationship between CCT and localized RNFL thickness defect in N TG patients. Sana Muhsen et al 2013[10] also reported advanced glaucomatous optic neuropathy was associated with thinner CCT in POAG & PACG patients.

However in thicker CCT group (501–550 μm) CCT is more positively correlated to RNFL loss in POAG group (r = 0.448) than in PACG group (r = 0.291) patients. It signifies that POAG patient are more vulnerable to RNFL loss than in PACG patients. Boonchai wang Supadilok 2014[11] also reported that in POAG patients RNFL thickness is moderately correlated with CCT.

The association between central corneal thickness and cup to disc ratio was previously documented by many authors. We also found a negative correlation in CCT and cup to disc ratio in both types of glaucoma patients.

In CCT group (450–500 μm) PACG patients shows more rapid increase in cup disc ratio (r = –0.652 vertical and r = 0.907 horizontal) cup to disc ratio than in PAOG patients (vertical CD ratio r = –0.018 and horizontal r = –0.022). This clearly suggest that there is more rapid glaucomatous damage in thin cornea group patients of PACG than POAG.

Our study results supports the observations by Alex W Hweitt et al 2005[6] that CCT is negatively correlated with cup to disc ratio in glaucoma patient as progressive thinning in CCT tend to increase in glaucomatous damage and increased cup to disc ratio. Boonchai Wang supandilok et al 2014[11] also suggested that CCT is negatively correlated with the cup to disc ratio in primary open angle glaucoma patients. We also found negative correlation between the CCT and cup to disc ratio in CCT group 501 – 550 μm. Tharwat H.mokbel et al 2010[8] also reported the negative correlation between CCT and optic disc area in PAOG patients which is consistent with our study results. However, Naim Teri et al 2011[9] reported in a clinically relevant correlation between optic disc size and CCT in POAG patients. This was not in accordance with our study that a thin cornea might be marker for cup disc.

While in CCT group 501 – 550 μm there is much more negative correlation between CCT and cup to disc ratio in POAG patients (r = – 0.104, r = – 0.44) than PACG patients (r = –0.097 vertical, r = –0.123 horizontal). This signifies that POAG patients exhibited more rapid increase in cup disc ratio with thinning of cornea.

Thus it suggests that there is more glaucomatous damage in the initial stages of POAG patients with the thin CCT as it is more positively correlated with RNFL thickness and also more negatively correlated with cup to disc changes.

Conclusion

It is now very clear in our study that CCT imposes a big impact upon diagnostic and prognostic parameters as RNFL and cup disc ratio. Thus any individual found to be having increased intraocular pressure, CCT should be mandatorily investigated by appropriate tool which is definitely having prognostic significance.

However, the present study also had certain limitations because sample size was small, and most of the patients of PACG presented late in our study with advanced glaucomatous damage. Also in our study the influence of other ocular factor as level of IOP, refractive error, size of eye ball upon RNFL and cup disc ratio which should also be considered.

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An Evaluation of Prevalence and Risk Factors of Computer Related Ocular Problems Among Engineering Students of Bangalore

Ashwini KV[1], Apoorva[2], Satyam Kumar[3], Nikitha Nataraju[4]

Abstract

Introduction: With the increasing use of technology for virtual classrooms, students are exposed to more of screen time be it computers or any Visual Display Terminals (VDT). This has resulted in a serious health issue known as Computer Vision Syndrome(CVS). Computer vision syndrome also referred to as digital eye strain is a condition in which a person experiences diverse set of ocular symptoms as a result of prolonged working on computer or any VDT's.[1] *Objectives:* This study was designed to evaluate the prevalence of CVS, the associated risk factors and awareness about the condition among the students of engineering college in north bangalore. *Materials and Methods:* a cross-sectional non interventional questionnaire based study was conducted among engineering students from may 2019 to oct 2019. Data was collected regarding the demography, use of spectacles/contact lens, duration of computer use, hours on computer per day, symptoms of CVS, awareness about CVS. *Results:* A total of 1000 students were enrolled for this study. The prevalence of CVS was found to be 82.3%. The most prevalent symptom was eye strain followed by headache. Significant association was found between increased hours of computer use and the prevalence of CVS ($p<0.01$). Though majority of students (76%) were aware of CVS only 24% of them were aware of the correct ergonomics. *Conclusion:* Extensive use of computers for work and recreational purposes is associated with an alarmingly high incidence of serious visual and other health problems. Clear and correct guidelines are needed to mitigate and reduce this health issue. Keeping this in mind, the health and educational professionals should pay considerable attention to CVS and adopt preventive measures to tackle this global health problem.

Keywords: Computer Vision Syndrome; Digital Eye Strain; VDT(Visual Display Terminal).

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Introduction

Now in the 21st century Computers and other Visual Display Terminals (VDT) have become an integral part of human life. The use of digital devices at Workplace, Universities, Schools and Homes for Education, Communication and Recreation has become necessity. The use of technology in our day to day lives is a double edged sword having both favourable and unfavourable consequences. Prolonged and extensive computer use poses serious health hazard both ocular and extraocular.

Computer Vision Syndrome (CVS), is commonly described as a group of eye and vision related problems, in particular near vision related problems, arising from extended and uninterrupted use of computer or digital screen use. It is also known as digital eye strain.[2] Common symptoms of CVS include dry and irritable eyes, eye strain/ fatigue, blurred vision, red eyes, burning eyes, excessive watering, double vision, headache, light/ glare sensitivity, slowness in changing focus and neck and shoulder pain that increases in severity with the increased use of Video Display Terminal (VDT).[3]

In a review on CVS by thomson showed that up to 90% of computer users have symptoms related

Author Affiliation: [1]Professor, [2]Post Graduate, [3]Optometrist, [4]Senior Resident, Ophthalmology and Institution, Sapthagiri Institute of Medical Sciences and Research Center (Sims & Rc), Bangalore 560090, India.

Corresponding Author: Ashwini Kv, Professor, Ophthalmology and Institution, Sapthagiri Institute of Medical Sciences and Research Center (Sims & Rc), Bangalore 560090, India.

E-mail: Ashwini_Kulenur@Yahoo.com

to computer use.[4] Hence, it is likely that CVS will continue to create a significant and growing contribution to reduced productivity at work, while also compromising the quality of life of the computer user which is compared to a study by ranasinghe on office going adult population.[5] In the present scenario of covid pandemic, the increasing use of vdts be it for online classes, projects, self study or entertainment has made it difficult to reduce the screen time for students thereby increasing the burden of cvs. So this study was designed to find the prevalence of cvs and its associated risk factors at the student level. As well as to know the awareness of cvs among the students and the preventive measures taken to tackle the problem.

Materials and Methods

A cross-sectional, non-interventional questionnaire based study was conducted among engineering students (Computer Science and Information Science Branch) in bangalore from may 2019 to Oct 2019.

All students who used computer for a minimum of six months were included in the study. Subjects were selected randomly regardless of their age, gender and visual status. Students who had existing eye disease and those who did not give consent to participate in the study were excluded.

The study was approved by the institutional ethical review board. In absence of uniform diagnostic criteria, a questionnaire was constructed based on previous study done by gangamma et al[6] on CVS. Questions included were about basic demographic data, hours of computer use per day, any ophthalmic or asthenopic symptom on using computers, any preventive measure taken to deal with symptoms, knowledge about computer vision syndrome. The students were asked to report eye symptom during or after use of computer and grade them as none, mild (transient symptoms persist for few minutes to hours), moderate (symptoms persistent for few hours and subsides on sleep or rest), severe (requiring medical consultation) visual problems during or after computer use.

To consider a symptom of Computer Vision Syndrome, symptoms should last for a day either during or after use of computer. Presence of any symptom mentioned in questionnaire either continuously or intermittently for at-least 1 week during or after computer use in the last one month was considered as presence of computer vision syndrome.

The data collected was analysed statistically using spss version 22. The descriptive data were presented as percentages and chi-square test to measure the strength of association and 95% confidence intervals were calculated.

Results

Demographic Profile

A total of 1000 students were included in this study based on inclusion criteria of which 46.3% Were females, while 53.7% Were males (Fig. 1).

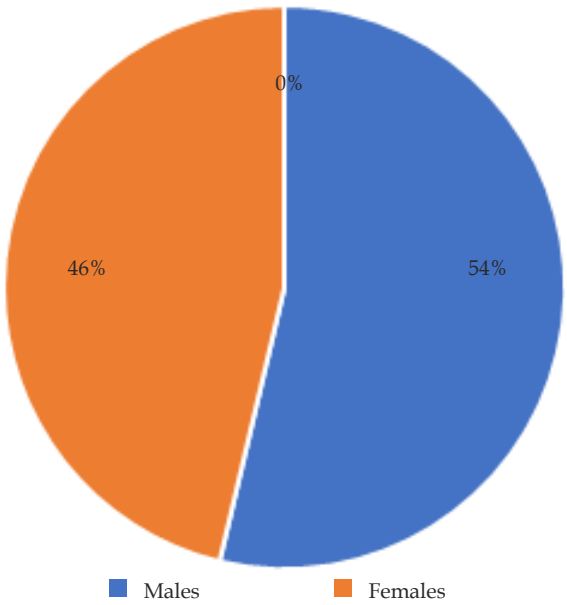

Fig. 1: Demographic Details

About 47% students were wearing spectacles or contact lens. Among them 68% (n=320) were using only spectacles, 30% (n=141) were using both spectacles and contact lens and 2% (n=9) were using only contact lens (Fig. 2).

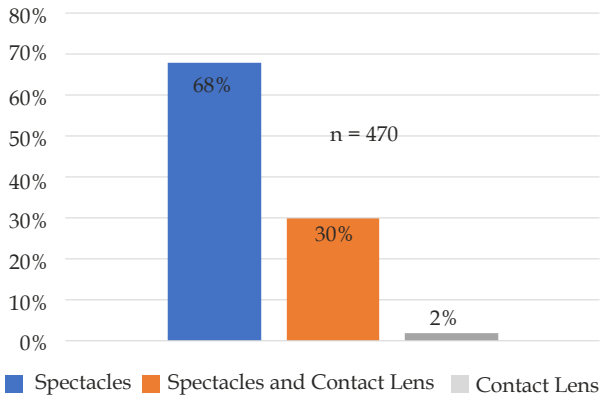

Fig. 2:

Out of total study subjects, 823 students reported history of one or more symptom of computer vision syndrome. Prevalence of Computer Vision Syndrome was found to be 82.3%. The commonest ocular symptom associated with computer usage was eyestrain complained by 640 (64%) students followed by headache in 182 students (28.2%) (Fig. 3).

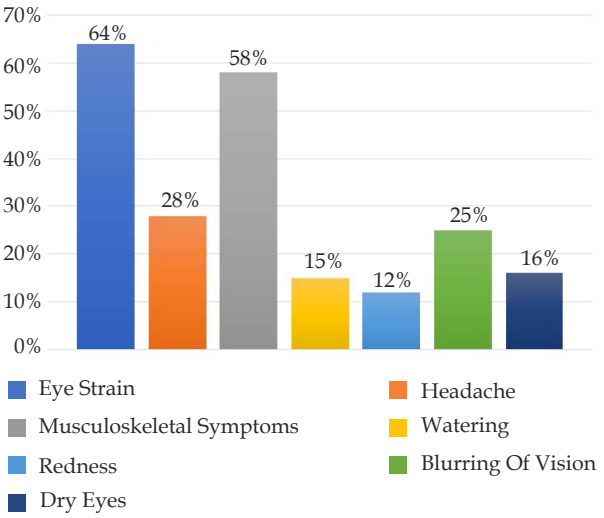

Fig. 3: Symptoms of CVS.

Majority of students were using computers for more than 6 hours a day (Fig. 4).

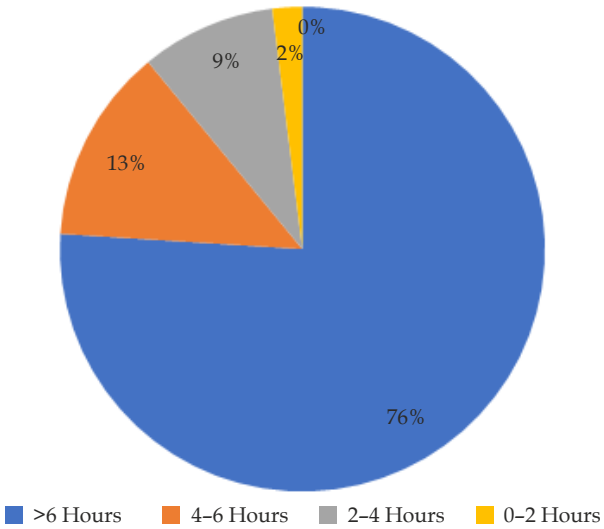

Fig. 4: Hours on Computer.

Table 1 showed that students who used computer for more than 6 hours were at significantly higher risk of computer vision syndrome compared to those who used computer for less than 6 hours ($p<0.01$). Significant correlation was found between increased hours of computer use and symptoms of Computer Vision Syndrome.

Table 1: Association of CVS with hours of Computer use.

Hours on Computer	N	CVS Present (N)	%	CVS Absent (N)	%
0–2	20	3	12	17	88
2–4	90	21	23	69	77
4–6	130	55	42	75	58
>6	760	490	64	270	36

Preventive Measures

Majority 76% of study population were aware about Computer Vision Syndrome but among them only 24% were aware about ergonomics of computer usage and preventive measures of Computer Vision Syndrome. The most common preventive measure adopted by students to relieve the ocular symptoms was taking breaks between computer use by 56% followed by use of VDT filters by 23%.

Discussion

The present study was conducted among 1000 engineering students of Bangalore. The prevalence of Computer Vision Syndrome in study population was found to be 82.3%. The prevalence was almost similar to other studies. Logaraj and Madhupriya reported prevalence of CVS between Medical & Engineering students were 78.6% And 81.9% Respectively.[7]

Most common symptom in our study was eyestrain and headache. These findings was consistent with study by sen a, richardson s which showed eye fatigue, headache and burning sensation as predominant symptoms.[8]

The present study found significant association between increase in hours of computer usage with the risk of computer vision syndrome. Student who spent time on computer for more than 6 hours were at high risk of compared to students who used computer for less hours. These results were consistent with a study by shrivastava and bobhate which found that visual symptoms increased with the increase in working hours on the computer.[9] Our study has pointed out serious threat to vision related health problems with increase time spent on computer and other VDT.

In our study the majority of students (760) were aware of health issues with use of computers but only 240 students had knowledge about ergonomics and preventive measures of CVS. In our study the most common practiced preventive measure to relieve the ocular symptoms due to computer use was taking frequent breaks while on computer.

This finding is consistent with result of a study by brewer which recommend frequent breaks and interventions to improve workplace ergonomics and will help to avoid computer vision syndrome.[10]

Limitation of our study was it was a cross sectional and it included students of a single university. This study didn't include ophthalmic examination and the severity of symptoms reported were subjective without any uniform diagnostic criteria. So further prospective follow-up study was required to know other associated risk factors and any permanent damage to eyes.

Conclusion

In this era of internet and online activities, computer and other VDT's have brought a change in overall lifestyle but at same time there is an alarming high incidence of serious vision and other health problems associated with extensive use of computers. Technology use by students is here to stay. So clear and correct guidelines are needed to mitigate and reduce this health issue. The health and educational professionals should consider these aspects and adopt preventive measures to tackle this global health problem.

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Recurrence of Primary Pterygium in Bare Sclera Versus Conjunctival Autograft Technique

Beatrice Choppara[1], Sara Sultana[2]

Abstract

Background: Pterygium is an abnormal fibrovascular subconjuctival tissue that encroaches upon the cornea causing visual disturbances. Surgical removal is the treatment of choice for pterygium. *Aim:* To compare the recurrence rate of pterygium in Bare sclera vs Limbal conjunctival autografting and to study the underlying risk factors associated. *Materials and Methods:* It is a prospective study conducted at Department of ophthalmology, Nalgonda Government Medical College, Nalgonda. Patients who presented with primary pterygium were grouped into 2 categories. Group 1 underwent baresclera technique. Group 2 underwent conjuctival autografting and were followed up for a period of 1 year. *Result:* In Group 1 showed recurrence rate of 30.50% (18 patients) as compared to Group 2 which showed recurrence rate o f 3.21% across all age groups. Males have recurrence rate of 39.02% (16 patients) in group 1 as compared to 2.43% (1 patient) in group 2. People employed outdoor have recurrence rate of 40.90% (18 patients) in group 1 as compared to 2.27% (1 patient) in group 2. Nasal pterygium has recurrencr rate of 36.8% (14 patients) in group 1 as compared to 2.63% (1 patient) in group 2. Mean recurrence rate was higher in Group 1 (34.66%) as compared to Group 2 (2.53%). *Conclusion:* Limbal conjunctival autografting is a safe effective procedure for pterygium surgery with lower recurrence rate.

Keywords: Pterygium; Recurrence; Conjunctival autograft; Bare sclera.

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Introduction

Pterygium is a common lesion occurring worldwide. The name "Pterygium" comes from the Greek word "Pterygos" which means "wing.".[1] It is an abnormal fibro-vascular subconjunctival tissue which encroaches the cornea. It is triangular in shape and is a benign lesion more frequently located nasally than temporally.

Ocular irritation, hyperemia and vision loss are the most common clinical symptoms.[2] The main histopathological change is elastotic degeneration of conjunctival collagen.[3]

In 1985 Kenyon et al first described conjunctival autografting for the management of recurrent pterygium and reported a low recurrence rate of 5.3% with this method.. Since then Limbal conjunctival autografting has been found to be a safe and effective procedure.[4–7]

However some studies still show some recurrence with conjunctival autografting,[8,9] hence it is necessary to study some of the underlying factors which influence pterygium recurrence.

In our study we aim to compare recurrence rates between two surgical techniques Bare sclera and Conjunctival autografting and study the underlying risk factors which influence recurrence of pterygium.

Materials And Methods

A prospective study was carried out at Government Medical College, Nalgonda from December 2018 to March 2020.

Author Affiliation: [1]Assistant Professor, [2]Senior Resident, Government Medical College, Nalgonda, India.

Corresponding Author: Sara Sultana, Senior Resident, Government Medical College, Nalgonda, India.

E-mail: dr.sarasultana14@gmail.com

130 patients who presented to the outpatient department with primary pterygium were selected.

These patients were grouped into two categories. Group 1 (60 patients) underwent pterygium excision with Bare sclera technique and Group 2 60 patients underwent pterygium excision with Limbal conjunctival autografting.

10 patients who lost follow up were excluded from the study.

Preliminary data comprising of age, sex and occupation were collected.

Preoperatively a thorough slit lamp examination was done including visual acuity and location of the pterygium. In cases of bilateral pterygia the more aggressive one was excised.

Systemic investigations such as blood pressure and random blood sugar were done and Written consent was obtained.

These patients were followed up post operatively at Day 1, 1 week, 1 month, 3 months, 6 months upto 1 year and recurrence and its time were noted.

Inclusion Criteria: All patients who presented with Primary pterygium.

Exclusion Criteria: Patients with recurrent ptergium, pseudopterygium, dry eye disease, collagen vascular disorders , those patients using antimetabolites such as Mitomycin C and 5–Flourouracil and those who lost follow up were excluded from the study.

Surgical Technique

5 ml of peribulbar block was given to attain anaesthesia.

10% povidone iodine was used to paint the skin and 5% povidone iodine instilled onto the conjunctiva.

Universal eye speculum was used to retract the lids and expose the globe.

The pterygium head was dissected using crescent blade and the cornea was scraped till the remnant tissue was removed. The body was dissected and separated from the conjunctiva and sclera using blunt holding forceps and westcott scissors taking care to avoid the rectus muscles.

In Group 1 patients, the pterygium was excised with westcott scissors and the sclera was left bare.

In Group 2 patients, after pterygium excision, a site for Limbal conjunctival autograft was selected from the superotemporal quadrant. 2% lignocaine was injected subconjunctivally to separate the conjunctiva from the underlying tenon's capsule.

The size of the graft is taken approximately 1mm larger than the defect created by pterygium excision on the conjunctival side and upto the limbus on the corneal side. The graft is rotated and placed on the bare sclera maintaining the limbus to limbus orientation. The sides of the graft were tucked into the adjacent conjunctiva i:e; the no glue no stitch technique.

The speculum was removed and pad and bandage applied for a day.

Postoperatively topical antibiotics were prescribed to Group 1 patients and Antibiotic steroid combination was given to Group 2 patients.

Follow up was done on Day 1, 3, 1 week, 1 month, 3 months, 6 months and 1 year and recurrence was noted.

Observation and Results

Table 1: Age wise distribution of Pterygium recurrence in Bare sclera vs conjunctival autograft technique.

In the 20–30 age group, 2 patients(50%) showed recurrence in group 1 and 0patients(0%) showed recurrence in group 2.

In 31–40 year age group, 9 patients (52.90%) showed recurrence in group 1 and 1patient (5%) showed recurrence in group 2.

In 41–50 years age group, 4 patients (19.04%) showed recurrence in group 1 and 1 patient (5%) showed recurrence in group 2.

Table 1: Distribution based on Age.

Age	No of Patients	Bare Sclera			Conjuctival Autografting		
		No of Pts	Recurrence	%	No of Pts	Recurrence	%
20–30	7	4	2	50%	3	0	0
31–40	34	17	9	52.90%	17	1	5.55%
41–50	41	21	4	19.04%	20	1	5%
51–60	25	12	2	16.66%	13	0	0
61 & above	13	6	1	16.66%	7	0	0
Total	120	60	18	30%	60	2	3.33%

Table 2: Distribution based on Sex.

Sex	No of Patients	Bare Sclera			Conjuctival Autografting		
		No of Pts	Recurrence	Rate	No of Pts	Recurrence	Rate
Male	82	41	16	39.02%	41	1	2.43%
Female	38	19	4	21.05%	19	0	0%
Total	120	60	20	33.33%	60	1	1.66%

Table 3: Distribution based on occupation.

Occupation	Total No of Pts	Bare Sclera Technique			Conjuctival Autografting		
		No of Pts	Recurrence	Rate	No of Pts	Recurrence	Rate
Outdoor	88	44	18	40.90%	44	1	2.27%
Indoor	32	16	6	4.25%	16	0	0%
Total	120	60	24	40%	60	1	1.66%

Table 4: Distribution based on Pterygium location.

Location	Total No of Pts	Bare Sclera Technique			Conjuctival Autografting		
		No of Pts	Recurrence	Rate	No of Pts	Recurrence	Rate
Nasal	85	43	14	32.55%	42	1	2.38%
Temporal	35	17	4	23.52%	18	1	5.55%
	120	60	18	30.50%	60	2	3.33%

Table 5: Comparative study of recurrence rate among various study of the world.

Studied by	Bare sclera technique		Conjuctival autogafting	
	No of pts	Recurrence rate	No of pts	Recurrence rate
Alpay et al 2009	21	8(38.09%)	18	3(16.6)
Khan et al 2010	30	11(36.6%)	34	3(8.82)
Ahmed et al 2012	15	06(40%)	15	1(6.66)
Kompalli et al 2016	25	6(24%)	25	2(8)
Present study	60	18(34.66%)	60	2(3.3)

In 51–60 years age group, 2 patients (16.66%) showed recurrence in group 1 and 0 patients (0%) showed recurrence in group 2.

In 61 years and above age group, 1 patient (16.66%) showed recurrence in group 1 and 0 patients (0%) showed recurrence in group 2.

18 patients (30%) out of 60 showed recurrence in group 1 where as in group 2, 2 patients (3.33%) out of 60 showed recurrence.

Table 2: Sex wise distribution of pterygium recurrence.

Out of the 120 patients presented 82 were male and 38 were female.

In group 1, 16 male patients (39.02%) out of 41 showed recurrence whereas in group 2, 1 male patient (2.43%) out of 41 patients showed recurrence.

4 female patients (21.05%) out of 19 in group 1 whereas 0 patients (0%) out of 19 in group 2 showed recurrence.

Irrespective of gender Group 1 patients showed more recurrence (33.3%) compared to group 2 (1.66%).

Pterygium occurred more commonly in outdoor.

Table 3: Incidence of pterygium recurrence based on occupation.

In this study 88 patients out of 120 were employed in outdoor occupation and 32 stayed in indoors.

There was a high incidence of recurrence noted in Group 1, 18 patients (40.90%) out of 44 patients as compared to group 2, 1 patient (2.27%) out of 44 showed recurrence in people employed in outdoor.

In indoor recurrence is noted more in group 1 compared to group 2.

Table 4: Pterygium recurrence based on location.

Pterygium mostly occurred nasally 76 out of 120 followed by temporally 32 out of 120 and least commonly occurred bilaterally 12 out of 120.

14 patients (36.8%) out of 38 in Group 1 and 1 (2.63%) out of 38 in Group 2 showed recurrence with nasal pterygia.

4 (25%) patients out of 16 in Group 1 and 1 (6.25%) out of 16 in Group 2 showed recurrence temporally.

2 (33.33%) patients out of 6 and 0 patients(0%) out of 6 showed recurrence who presented with bilateral pterygium.

Discussion

Pterygium is a common disease especially in tropical countries like India mainly due to hot and dusty climate. Various surgical techniques have been devised to prevent the recurrence of ptergium but Conjunctival autografting remains the most effective method with least recurrence rates.[10–13] This finding is in correlation to our study.

This study compares the two commonly performed procedures Bare Sclera vs Conjunctival Autografting in 120 patients who were grouped into two categories, 60 patients (Group 1) underwent Bare sclera technique and 60 patients (Group 2) underwent Conjunctival Autografting. The recurrence was found to be significantly higher in Group 1 as compared to Group 2.

Limbal stem cells act as a barrier against conjunctival invasion of the cornea which explains the lower recurrence rates in conjunctival autografting technique.[14]

The incidence of pterygium was found to be higher in individuals in the younger age group (<40 years), these patients also showed higher recurrence due to increased fibroblastic and inflammatory activity.

Males and people employed in outdoor occupations such as farmers and drivers showed higher incidence of pterygium due to exposure to ultraviolet radiations.[15] These patients showed more recurrence with Bare sclera technique.

Nasal location is the commonest site for the occurrence of pterygium due to focusing of ultraviolet radiation in that area. Nasal pterygia showed higher recurrence with Bare Sclera technique.

The average time after which pterygium recurrence was noted is 1 year.

The average time duration for the recurrence of ptergium is approximately 1 year post surgical excision.[16]

Conclusion

Higher incidence of pterygium is observed in young males, outdoor workers and on the nasal side. Bare sclera technique has higher recurrence rates compared to Conjunctival autografting. Hence, Limbal conjunctival autografting proves to be an efficient, safe and cost effective technique to prevent pterygium recurrence.

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Original Article

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Profile of Emergency Ophthalmic Consultation in A Tertiary Care Hospital

Ramachandra S[1], Ravindra R[2], Kumar SS[3], Bhat SH[4], Darshan SM[5]

Abstract

Introduction: Eye emergencies may range from trivial trauma to sight threatening complications. The number of patients seen in an emergency department, after working hours, has been increasing in the recent times. Ophthalmic inpatient, outpatient, surgical and emergency services in a tertiary care hospital are available round the clock which may be sought for screening, diagnosis and management of ophthalmic & systemic conditions of varied manifestation. Information regarding the profile of ocular emergency reference in each setting is important for strategic planning of efficient service allocation. The aim of this study was to investigate the profile of cases that were referred for emergency ophthalmic consultation: in a tertiary care centre in Kolar, with an effort to identify the true ophthalmic emergencies. *Materials and Methods:* A retrospective study was conducted over a period of one year, from December 2017 to November 2018 and the data of 1842 was collected from the emergency register of the department of Ophthalmology. *Results:* This study was conducted among 1842 subjects. Majority of them were men. The most common presenting age group was in between 21–30 years. Most of the referrals were due to hypertension followed by diabetes. Just 2.9% of the subjects presented with pure ocular complaints, with non-infectious conditions forming a majority. Of those patients presenting with trauma, RTA was the most common cause. *Conclusion:* In conclusion, the ophthalmologist plays a pivotal role in diagnosing the severity of non-emergency conditions like diabetes, hypertension and papilledema, PIH when referred in a tertiary health care centre. A dedicated ophthalmic emergency care team should be competent to manage primary ophthalmic emergencies, be a part of the emergency trauma team and interdisciplinary health care delivery system

Keywords: . Emergency Ophthalmic Consultation.

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Introduction

Any ocular condition that requires immediate care to prevent permanent impairment of vision is considered as an ocular emergency and can range from symptomatic emergencies like trauma, uveitis, retinal detachment, acute angle closure glaucoma to asymptomatic emergencies like papilledema.[1]

Author Affiliation: [1]HOD, [2]Senior Resident, [3,4]Post Graduate, [5]Former Senior Resident, Department of Ophthalmology, Sri Devaraj Urs Medical College, Kolar, Karnataka, India.

Corresponding Author: Reshma Ravindra, Senior Resident, Department of Ophthalmology, Sri Devaraj Urs Medical College, Kolar, Karnataka, India.

E-mail: resh1627@gmail.com

Eye emergencies may range from trivial trauma to sight threatening complications which not only affects the physical and psychological status of an individual but also deprives the society of the optimum beneficial services that an individual can offer.[2]

The number of patients seen in an emergency department, after working hours, has been increasing in the recent times, probably due to the convenience of the patients to visit after their work, references given by other departments in a tertiary hospital or because of examining even the non-emergency conditions in the emergency department (ED).[3]

Due to lack of knowledge, patients don't realize the need for a regular check, hence miss out on the progression of retinopathic changes due to diabetes

mellitus or hypertension and are referred to an ophthalmologist by a general physician or surgeon, which might often be too late.[4] It has been found, according to studies that 5–82% of patients who present to emergency department are in fact for non-emergency complaints.[4]

This diversity in the presenting number of cases is probably due to the contrast in study population or due to the benchmark taken for urgency.[5]

Majority of the population seek efficient, multispeciality affordable health care which is provided by medical colleges.[6]

Ophthalmic inpatient, outpatient, surgical and emergency services in a tertiary care hospital are available round the clock which may be sought for screening, diagnosis and management of ophthalmic & systemic conditions of varied manifestation.[7]

In most such institutions, the cases seen by an ophthalmologist after working hours are due to inter department references which help in diagnosing a large variety of ocular manifestations of systemic diseases.[6]

It has also been observed that the severity of systemic illness is more in inpatients when compared to those coming to the OPD making the referral examination more important.[7]

Systemic disorders like diabetic and hypertensive emergencies that can easily be detected by direct ophthalmoscopy require the expertise of an ophthalmologist by a thorough examination of fundus.[8]

Information regarding the profile of ocular emergency reference in a given setting is important for strategic planning of efficient service allocation. The aim of this study was to investigate the profile of cases that were referred for emergency ophthalmic consultation: in a tertiary care centre in Kolar, with an effort to identify the true ophthalmic emergencies.

Materials and Methods

A retrospective study was conducted over a period of one year, from December 2017 to November 2018 and the data was collected from the emergency register of the department of Ophthalmology. The patient details,primary diagnosis, the referring department and the ophthalmic findings were considered for the study. The Institutional Ethical Clearance as per declaration of Helsinki, was obtained prior to the data collection.

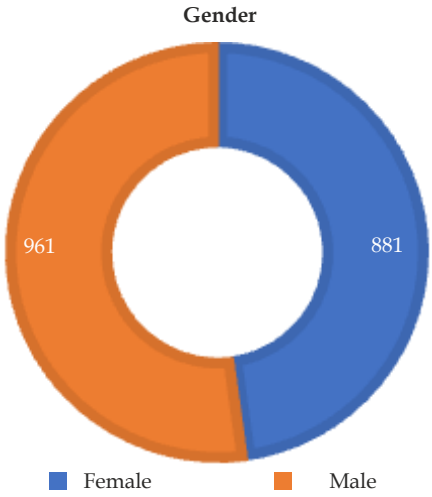
Observation

A retrospective study was conducted for one year to study the emergency profile of ophthalmology cases that presented after OPD hours, in a tertiary health care institute, in Karnataka. The total number of subjects were 1842.

Table 1: Gender distribution of patients studied.

Gender	No. of Patients	%
Female	881	47.8
Male	961	52.2
Total	1842	100.0

Graph 1: Gender distribution of patients studied.



A majority, 52.2%, of them were men and the rest women.

Table 2: Age distribution of patients studied.

Age in years	Gender		Total
	Female	Male	
0–10	46(5.2%)	46(5.4%)	86(5.3%)
11–20	85(9.7%)	57(6.7%)	132(8.1%)
21–30	304(34.5%)	139(16.4%)	407(25.1%)
31–40	78(8.9%)	137(16.2%)	208(12.8%)
41–50	92(10.4%)	116(13.7%)	197(12.1%)
51–60	117(13.3%)	156(18.4%)	259(15.9%)
61–70	109(12.4%)	141(16.6%)	237(14.6%)
71–80	25(3.2%)	42(5%)	67(4.1%)
81–90	19(2.4%)	12(1.4%)	31(1.9%)
>90	0(0%)	2(0.2%)	2(0.1%)
Total	776(100%)	848(100%)	1624(100%)

This study shows a wide age distribution among the subjects, between 1 to 90 years old. The most common presenting age group was in between 21–30 years, followed by 51–60 years. Majority of women 34.5% belonged to the age group 21–30 whereas majority of male subjects belonged to the age group of 51–60.

Graph 2: Age distribution of patients studied.

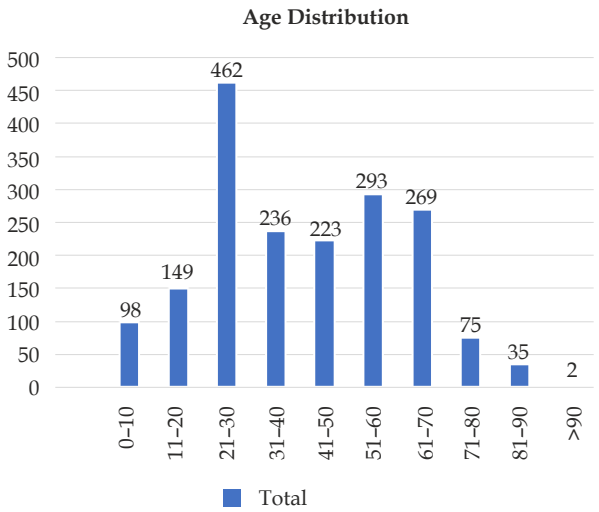


Table 3: Profile of cases presenting as emergencies.

Diabetes Mellitus + Hypertension	953
Medical Condition	567
Injuries	257
Eye Condn	54
Surgical Condn	11

Graph 3: Profile of cases presenting as emergencies.

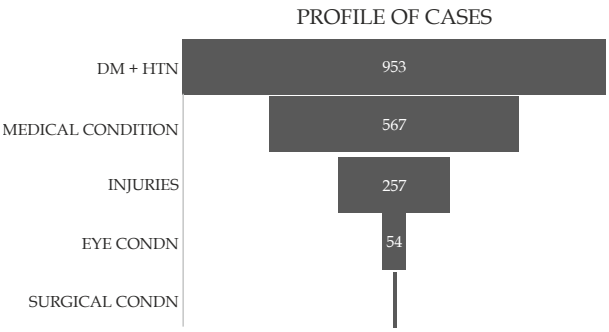
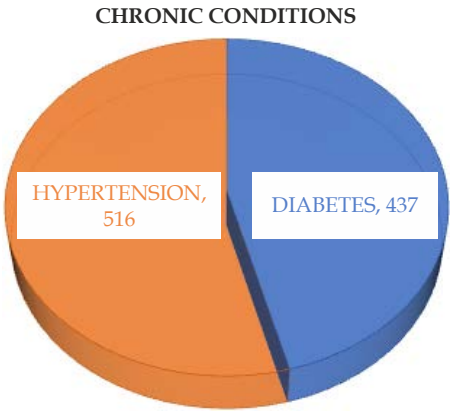


Table 4: Chronic Cases.

Chronic Conditions	No.
Diabetes mellitus	437
Hypertension	516

Graph 4: Chronic Cases.



Most of the patients who came to the emergency department were mostly with medical conditions like hypertension & diabetes mellitus which constituted about 51.73%. Among this, 54.14% of them were hypertensives and the rest were diabetic patients.

Table 5: List of Medical Conditions.

SL No	Medical Conditions	Count
1.	Eclampsia	204
2.	Pre-eclampsia	104
3.	Seizures	58
4.	Encephalitis	42
5.	Headache	35
6.	Chronic kidney disease	33
7.	Meningitis	23
8.	Anemia	11
9.	Neurocysticercosis	10
10.	Shock	06
11.	Cavernous sinus thrombosis	05
12.	Encephalopathy	05
13.	Retro positive	05
14.	Diabetic keto acidosis	04
15.	Hypertensive emergency	04
16.	Lung cancer	04
17.	COPD	03
18.	HELLP syndrome	02
19.	Hemiparesis	02
20.	7th Nerve palsy	01
21.	DIC	01
22.	Fat embolism	01
23.	Fungicide poisoning	01
24.	Neurotoxoplasmosis	01
25.	SLE	01
26.	Thrombocytopenia	01

Medical conditions other than hypertension & diabetes mellitus came in next, comprising of 30.78% of the total. Of these patients, most of them were references from the OBG department for eclampsia (35.97%) and pre eclampsia (18.34%). Other conditions like seizures (10.23%), encephalitis, headache, chronic kidney disease, meningitis, anemia, neurocysticercosis, shock, cavernous sinus thrombosis, encephalopathy, retropositive, diabetic keto acidosis, hypertensive emergency, lung cancer, COPD, HELLP syndrome, hemiperesis, 7th nerve palsy, DIC, fat embolism, fungicide poisoning, neurotoxoplasmosis, SLE and thrombocytopenia (0.1%) comprised of the remaining cases.

Out of 1842 subjects, just 54(2.9%) presented to the emergency department with pure ocular complaints.

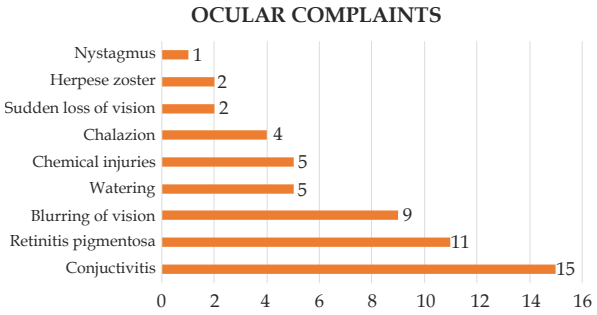
Majority of them presented with non-infectious conditions in which a most of them who presented

with diminished vision were found to have retinitis pigmentosa (20.37%) whereas 16.67% of them presented with blurring of vision. The others presented with watering of the eye, chalazion, sudden loss of vision and nystagmus. Among the infectious etiology, it was found that a majority of them presented with (27.79%) acute conjunctivitis and the rest with herpes zoster.

Table 6: List of pure ocular complaints.

Sl No	Non Infectious	Count	Sl No	Infectious	Count
1	Watering	05	1	Herpese zoster	02
2	Sudden loss of vision	02	2	conjuctivitis	15
3	Blurring of vision	09			
4	Chalazion	04			
5	Chemical injuries	05			
6	Retinitis pigmentosa	11			
7	Nystagmus	01			

Graph 4: Ocular Complaints.



Injuries

Table 7: Mode of Injuries.

Sl No	Mode of Injuries	Count
1	Road traffic accident	221
2	Foreign body	17
3	Burns	04
4	Dog bite	02
5	Chemical injuries	07
6	Stick injury	04
7	Fire cracker injury	02

Next set of subjects presented to the emergency due to trauma 13.95%. A majority of which was due to RTA – 85.99% which included lacerations, periorbital oedema, subconjunctival haemorrhage, ecchymosis and traumatic cataract. 6.61% of them presented with a foreign body to the eye. The remaining were due to chemical injuries, burns, stick injury, dog bite and fire cracker injury.

Graph 5: Mode of Injuries.

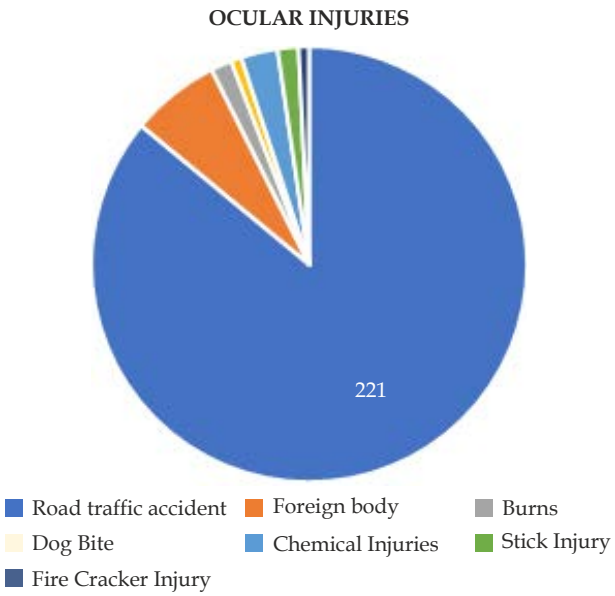


Table 8: Surgical causes.

SL NO	Surgical Conditions	Count
1.	Snake Bite	04
2.	Epistaxis	03
3.	Intra Cranial Bleed	02
4.	Pancreatitis	02
5.	Frontal Fungal Sinusitis	01
6.	Intra Cranial Embolism	01
7.	Sub Dural Heamorrhage	01
8.	Axonal Injuries	01
9.	Hydrocephalus	01
10.	Schwannoma Tumour	01
11.	Ruptured Aneurysm	01
	Total	18

Just 0.59% of them presented to us secondary to surgical complications. 22.22% was to rule out vascular complications due to snake bite. The rest were mainly to rule out papilledema secondary to raised ICT due to intra cranial bleed, hydrocephalus, schwannoma tumour, ruptured aneurysm, intra cranial embolism.

Results

This study was conducted among 1842 subjects. Majority of them were men. The most common presenting age group was in between 21–30 years. Most of the referrals were due to hypertension followed by diabetes. Just 2.9% of the subjects presented with pure ocular complaints, with non-infectious conditions forming a majority. Of those patients presenting with trauma, RTA was the most common cause.

Discussion

Successful outcomes in emergencies depend on timely presentation and intervention which will help in minimizing the vision loss and provide a chance at better visual prognosis[9] especially in a teaching hospital.[6]

This study shows a diverse age distribution ranging from 1 to 90 years. The most common presenting age group was in between 21–30 years, followed by 51–60 years representing the productive age group of the society. A study by May et al., showed similar results with 58 of the patients visiting the emergency being less than 30 years of age. [10] Studies conducted in Nigeria showed similar results with most of the patients being less than 50 years of age.[11] 33.2% of the patients were less than 30 years of age, similar to the studies done by Joseph et al., this might be due a higher incidence of outdoor activities by this age group.[1]

Males constituted 52.2%, of our study subjects, a finding similar to other studies that show that men are more susceptible to ocular emergencies or trauma due to occupational hazards, greater participation in adventure sports, propensity to accidents probably due to the influence of drug and alcohol.[12,4] Resnikoff et al. suggested that the numbers might be more in men than in women because men seek health care more often than women.[13]

Majority of the emergency ophthalmic consultations (51.73%) were referrals associated with medical conditions like hypertension (54.14%) & diabetes mellitus (45.86%).

In patients with hypertensive urgency, it can be a significant marker of target organ damage.[14] This will help in better care of the patient with due importance to multi system management.

The importance of hypertensive retinopathy is mostly due to its association with stroke. The presence of retinopathy maybe an indicator to initiate antihypertensive therapy.[15]

45.86% of patients were diabetics in the present study. A study conducted in Malaysia by Tajunisah, et al7, and Australia studyby Chandra Bala Et. Al.,[16] showed that majority of the diabetic inpatient references were to rule out diabetic retinopathy.

A study conducted in Australia differed in that majority of ophthalmology references were from in patient with a recent history of stroke, nerve palsy or were on long term steroids mostly from department of surgery and medicine.[17]

30.78% of emergency ophthalmic consultations were from the Obstetrics & Gynaecology department (eclampsia (35.97%) and pre eclampsia (18.34%)) and other medical conditions like seizures, encephalitis, headache, chronic kidney disease, meningitis, anaemia, neurocysticercosis, shock, cavernous sinus thrombosis, encephalopathy, retropositive patients, diabetic keto acidosis, hypertensive emergency, lung cancer, COPD, HELLP syndrome, hemiparesis, 7th Nerve palsy, DIC, fat embolism, fungicide poisoning, neurotoxoplasmosis, SLE and thrombocytopenia.

A study conducted by Joseph et.al.[1] showed that most of their referral cases were of non-emergency type and constituted about 57.5%.[1]

A study conducted by Sridhar Et. Al showed that 35.8% of the patients who visited the EMD were due to non – emergency causes.[3] Similar results were found in studies conducted in the United States that also showed that majority of cases were not an emergency, Uscher – Pines et al., study showed that 37% of the cases in their literature review of 26 articles conducted, were of non-emergency types.[18] Similar study series conducted in ophthalmology departments all over the world show that the rate of non-emergency cases are about 50–70%.[19] Similar to this, a study done in Nigeria showed that non traumatic emergencies summed up to 47.7%.[19]

However, this is in contrary to some studies conducted in the developing parts of the world with higher incidence emergency referrals for trauma. This might be due to poor road traffic awareness or lack of precautions taken by them during driving or at work or due to inadvertent use of over the counter medications resulting in worsening of the otherwise simple eye conditions.[1]

2.9% of the entire study population, primarily presented to the emergency department with pure ocular complaints. Majority of them, (68.5%) were non-infectious conditions like retinitis pigmentosa (20.37%). 16.67% presented with nonspecific blurring of vision and the others presented with watering of the eye, lid swelling, sudden loss of vision and nystagmus.

31.5% of the primary ocular emergency consultations were attributed to infectious causes , majority being acute conjunctivitis (88.23%) and the rest to rule out ocular involvement in herpes zoster involving the eyelids.

This is somewhat comparable to a study conducted in Miami, USA, which showed that the most common presenting ocular finding was conjunctivitis, corneal abrasion, dry eye, foreign body and corneal ulcer.[3]

A study conducted in Australia showed that conjunctivitis was the most common finding followed by keratitis, cataract, corneal abrasion and iridocyclitis in a metropolitan hospital.[20]

Three separate studies, under altogether different conditions, conducted in Ophthalmology clinics in Great Britain by Price et al[21]., Vernon et al[22]., and Jones et al[23]. reported that their most common diagnosis was corneal foreign body followed by meibomian gland dysfunction, corneal abrasion and conjunctivitis.

A study conducted in Brazil showed that acute infections of the eye like conjunctivitis, chalazion, keratitis, endophthalmitis and herpes zoster was the second most common cause of presentation to the ED after trauma.[4]

13.95% of the subjects presented to the emergency department with trauma, mostly due to RTA (85.99%). These patients had lacerations, periorbital oedema, subconjunctival haemorrhage, ecchymosis and traumatic cataract at presentation. 6.61% of them had corneal foreign body which conforms to the study conducted by Voonet.a l.[24] Chemical injuries, burns, stick injury, dog bite and fire cracker injury constituted the rest of the trauma a cases.

Thus studies have shown that an ophthalmologist's help has a critical role in diagnosing systemic conditions and has a key role in referring a patient to a clinician, like the detection of Kayser Fleischer rings could point to Wilsons disease, CMV retinitis is indicative of HIV infection and papilledema maybe due to raised ICT.[n]

Conclusion

In conclusion, the ophthalmologist plays a pivotal role in diagnosing the severity of non-emergency conditions like diabetes, hypertension and papilledema, PIH when referred in a tertiary health care centre.

Inputs of ophthalmoscopy forms an integral part of management pregnancy induced hypertension and related complications. Triage when done in cases of polytrauma or pure ophthalmic trauma will benefit not only in prioritising the critical cases needing ophthalmic services but will also help in optimal utilising of manpower. A dedicated ophthalmic emergency care team should be competent to manage primary ophthalmic emergencies, be a part of emergency trauma care and interdisciplinary health care delivery system.

In pure ocular injuries like chemical injuries, globe rupture, etc, early diagnosis and prompt intervention will help in preserving the visual function in the patients.

A dedicated ophthalmic emergency care team should be competent to manage primary ophthalmic emergencies, be a part of the emergency trauma team and interdisciplinary health care delivery system.

Limitations

A complete ocular diagnosis and visual morbidity assessment was not captured in the data collected. Also, there was no follow up data available.

Abbrevations

CMV– Cyto Megalo Virus

COPD– Chronic Obstructive Pulmonary Disease

DIC– Disseminated Intravascular Coagulation

ED– Emergency Department

HELLP– Haemolysis Elevated Liver Enzymes Low Platelet count

HIV– Human Immunodeficiency Virus

ICT– Intracranial Tension

OBG– Obstetrics and Gynaecology

OPD– Out Patient Department

PIH– Pregnancy Induced Hypertension

RTA– Road Traffic Accident

SLE– Systemic Lupus Erythematosus

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Original Article

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A Study to Correlate Ocular Manifestations of Closed Head Injury with Glasgow Coma Scale and Vision and Neurological Outcome in A Rural Tertiary Care Center

Sandhya R[1], Manu Saini[2]

Abstract

Purpose: To evaluate and document various ocular manifestations in patients with closed head injury and to evaluate and document the neurological status by Glasgow Coma Scale (GSC) score at the time of presentation and to compare the association between them. *Materials and Methods:* A prospective study was undertaken which included a total of 85 patients of ocular trauma. Conscious status was assessed using Glasgow coma scale. Thorough examination of anterior segment, posterior segment, extraocular movements, visual acuity and investigations were carried out for all patients. *Results:* The highest incidence of head injuries was in the age group of 21 to 30 years. There were 60 males and 25 females. The mean age for males was 34.14 ± 14.4 and the mean age for females was 45.43±12.44. In this study, 4.70 % cases of severe head injury cases had posterior segment manifestations. And 3 patients with pupillary abnormalities, i.e 3.52%. And 1.17% patients had traumatic optic neuropathy manifestations. During follow up visits, there was improvement in ocular manifestations and GSC score. *Conclusion:* In severe head injury (GCS 3–8), it is important to look for posterior segment findings and neuro-ophthalmic manifestations. A detailed ocular assessment during the first presentation in all cases of head injury patients is mandatory as it helps in better management and the final outcome could be improved with better diagnosis and management.

Keywords: Closed head injury; Ocular manifestations; GCS score.

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Introduction

Traumatic head injury is increasingly recognised as a major cause of morbidity and mortality worldwide.[1] Industrialization and modern modes of transportation has amplified the frequency of accidents and consequently, trauma to the skull.[2] These injuries are responsible for 50% of trauma deaths and 60% of road traffic accident deaths.[3] The proximity of eyes to the brain, leads to the high frequency of association of skull injuries with ocular injuries and consequent morbidity.[4] Half a million or so people are blinded by ocular trauma, worldwide. Partial loss of sight is documented in many others. Mono-ocular blindness is also one of the consequence of trauma.[5] Therefore, ocular manifestations of traumatic head injuries play a major part in causation of blindness and as a prognostic factor for patients. Secondarily, due to head trauma, ocular manifestations and associated complications may have varied presentations and may change within a short period of time. Clinical evaluation of ocular manifestations is vital in early localization of the site of injury for better management, and improved visual outcome of the patient.[6,8] Despite of the significant problems associated with ocular manifestations of head trauma, literature does not have enough data which shows the whole picture of the problem. This study aims to evaluate and document various ocular manifestations in patients having closed head injury and correlate them with the patients' neurological status assessed by Glasgow Coma Scale (GCS) scoring and to compare any association between them.

Author Affiliation: [1]Professor and HOD, [2]Junior Resident, Department of Ophthalmology, Pgwomens Hostel, SDUMC, Kolar 563101.

Corresponding Author: Manu Saini, Junior Resident, Department of Ophthalmology, Pgwomens Hostel, SDUMC, Kolar 563101.

E-mail: manu18.saini@gmail.com

Method of Collection of Data

A prospective study was undertaken including 85 patients of closed head injury, reporting to the emergency department at R.L.J. Hospital And Research Centre, Tamaka, Kolar attached to Sri DevarajUrs Medical College between January 2018 and May 2019. Patients with prior history of any neurological disease and ocular trauma were excluded. Detailed history regarding injury was documented. Patients were examined at the time of presentation, at 1 week, 4 weeks and 6 weeks after the injury and the neurological and visual outcome was evaluated and documented and the association, if any, between the two was analysed. Consciousness status was assessed using Glasgow Coma Scale. Ophthalmic examination included assessment of external injury, anterior segment examination, pupillary reaction, visual acuity, assessment of extra-ocular movements, visual field assessment by finger confrontation, fundus examination by direct or indirect ophthalmoscopy. If necessary, assessment of visual acuity using Snellen's chart, assessment of intra ocular pressure using Goldmann applanation tonometer, and diplopia charting was done.

Results

Out of the total 85 patients examined, 60 subjects were males and 25 were females.

Table 1: Gender distribution.

Gender	Frequency	Percentage
Male	60	70.58
Female	25	29.41
Total	85	100

Table 2: Distribution of patients according to age and sex.

Age (Years)	Male	Female	Total
<20	3	–	3
21–30	23	11	34
31–40	13	4	17
41–50	10	8	18
51–60	4	2	6
61–70	5	–	5
>70	2	–	2

The age distribution of the patients ranged from 4 months to 76 years with mean age of 35.20 years. The age range of 21–30 years accounted for the maximum number of patients among males & females.

Table 3: Frequency of the ocular manifestations at the time of presentation as seen in casualty/sicu/picu.

Ocular Manifestations	Frequency	Percentage
Periorbitaloedema	46	54.11
Ecchymosis	18	21.17
Eyelid laceration	22	25.88
Abrasion	1	1.17
Subconjuctivalhaemorrhage (SCH)	13	15.29
Corneal tear	6	7.05
Pupillary abnormality	3	3.52
Fundus findings	4	4.70

Periorbital oedema was the most common presentation, seen in 46 patients out of 85, i.e 54.11%, followed by eyelid lacerations, which was seen in 22 patients, i.e 25.88 %. Ecchymosis was seen in 21.17%, SCH in 15.29% and corneal tear in 7.05% patients. Pupillary abnormalities and fundus findings were there in 3.52% and 4.70% patients respectively.

Table 4: Distribution of cases according to GCS at presentation.

GCS Score	Frequency	Percent
14, 15 (Mild)	76	89.4
9–13 (Moderate)	6	7.1
5–8 Severe	3	3.5
Total	85	100.0

Out of 85 patients, 76 had GCS score 14,15 that is 89.4% patients with closed head injury had normal GSC score.[6] 7.10% had GCS score in the range of 9–13, and 3.5% patients had GSC score in the range of 5–8.

Table 5: Visual acuity at the time of presentation.

Visual Acuity	Frequency	Percent
More than counting finger 3m	62	72.94
Less than counting finger 3m	13	15.29
Could not be assessed	10	11.76
Total	85	100

Visual acuity was greater than counting fingers 3m in 72.94% patients, and it was lesser than CF 3m in 15.29% patients. Vision could not be assessed in 11.76% patients.

Table 6: GSC category and trauma to the ocular adnexae.

GCS Category	Cases with Trauma to Ocular Adnexa	Percent
Mild	67	72.94
Moderate	2	2.35
Severe	0	–

Among 69 patients who had injury to ocular adnexa, 72.94% cases had mild head injury, whereas 2.35% cases had moderate head injury.

Table 7: GCS and Significant post trauma anterior segment findings.

GCS Category	Cases with Trauma to the Anterior Segment	Percent
Mild	16	18.82
Moderate	3	3.53
Severe	0	–

22.35% patients had injury to anterior segment. Among these, 18.82% patients had mild head injury and only 3.53% patients had moderate head injury.

Table 8: GCS category and post trauma posterior segment findings.

GCS Category	Cases with Trauma to the Posterior Segment	Percent
Mild	–	–
Moderate	1	1.17
Severe	3	4.70

Out of 85 patients, 4 had posterior segment manifestations, i.e 4.70%. 1 patient had moderate head injury and 3 patients had severe head injury.

Table 9: GCS score and VA correlation at the time of presentation.

Head injury severity As GCS score	VA(at presentation)			Total
	CF>3m	CF<3m	Could not be assessed	
Mild	61	11	4	76
Moderate	1	2	3	6
Severe	0	0	3	3
Total	62	13	10	85

71.76% patients with mild head injury patients had vision CF>3m and 12.94 % had vision CF <3m. For 4.70% patients it could not be assessed.Vision could not be assessed for 3.52% patients who had moderate head injury, 2.35% had vision CF<3m and 1.17% patients had vision CF>3m. And in all 3 patients of severe head injury, vision could not be assessed.

Table 10: Ocular manifestations at 1 week as seen during follow up in SICU/ophthalmology OPD.

Ocular Manifestations	Frequency	Percent
Periorbital oedema	10	17.85
Ecchymosis	10	17.85
SCH	9	16.09
Pupillary abnormality	1	1.78
fundus findings	2	3.57
Nil	26	46.42

At 1 week of follow up, out of 85 patients, follow up of 26 patients was lost, 3 patients died due to head trauma complications. The most common ocular findings were periorbital oedema and ecchymosis, both seen in 10 patients, out of 56 patients, with the frequency of 17.85% each.

Table 11: Distribution of cases in categories according to Glasgow Coma Scale(GCS) score at 1 week.

GCS score	Frequency	Percent
14,15 (Mild)	55	98.21
9–13 (Moderate)	1	1.79
5–8 (Severe)	–	–
Total	56	100.0

GCS score of 55 patients out of 56 was 15.One patient scored 12 on the GCS scale. All patients with lids and adnexa manifestations at 1 week follow up, had mild head injury Anterior segment manifestations patients had mild head injury at 1 week of follow up.

Table 12: Showing frequency of ocular manifestations at 4 weeks.

	Occurrence	Percent
No ocular findings	46	47.1
Ecchymosis	1	1.2
Death	4	4.7
Lost follow up	34	40.0
	85	100.0

At 4 weeks of follow up, only 47 patients were followed up, out of which, 1 had ecchymosis and other 46 had no ocular findings, either due to head injury or due to direct trauma.

Follow up was lost for another 7 patients and 1 more patient died since the last follow up. All patients examined at 4 weeks had GCS score of 15. At 6 weeks, 45 patients were followed up, none of them had any ocular finding, either due to primary head injury or due to direct ocular trauma, All patients had GCS score of 15.

Discussion

According to the undertaken study, patients who were in the age range of 21 to 30 years were the ones who got affected the most. There were 60 males and 25 females. For men, the age ranged from 4 months to 70 years with the mean age of 34.14 years. The age range for female patients was from 21 to 75 years, mean being the 45.43 years. The majority of males who were affected had age ranging from 21–30 years (23 cases) and the majority of affected females were also in the age group 21–30 years (11

cases). In the study by Odebode et al[6], showed the high frequency of affected male patients compared to female patients; i.e male–37 (64.9%) > 20 (35.1%) female subjects. In the study by Kulkarni et al[7], a total number of two hundred patients were examined of CHI, out of which 194 i.e 97% were males patients and 6 i.e 3% were females. The age ranged from 5 to 67 years, with a Mean of 28.08 years. 5–67 years was the age range of men with a Median of 27.85 years. And for female patients it was 14–47 years with mean age as 35.33 years. Male patients with the age range of (21–30 years) were more prone to head trauma, i.e 62%. In the study by Smitha et al[2], men formed the major portion of the study population which was 92% patients and 8% were the female patients. The demographic report of closed head injury cases of the undertaken study correlates with the conclusions of various other studies, showing that male population is more commonly involved, mainly because men more frequently go out and travel more for work and men have more probability to be involved in industrial activity. They are more likely to go through from alcohol abuse which can lead to motor traffic catastrophies and assaults. In this study, we saw that more commonly occuring ocular finding was periorbital oedema, in 54.11% patients, followed by eyelid lacerations, seen in 22 patients, i.e 25.88%. Ecchymosis was seen in 18 patients, 21.17%. Subconjuctival haemorrhage was present in 13 patients. Periorbital skin abrasions were present in 1 patient, 6 patients had corneal tear. Pupillary abnormalities were observed in 3 patients,posterior segment findings i.e 4.70%, as Papilloedema in 1 patient, macular edema 1, Purtscher's retinopathy in one case and Traumatic optic neuropathy in 1 patient. According to a study done by Kulkarni et al[7], the commonest ocular finding was observed as ecchymosis in 54 (27%) patients followed by subconjunctival haemorrhages in 38 (19%) patients. 24 patients (12%) were observed to have orbital wall fractures . Papilloedema was seen in 11/200 cases (5.5%), macular edema in 4/200 cases (2%), retinal haemorrhage in 1(0.5%) case, vitreous haemorrhage in 1(0.5%) case, corneal tear in 2(1%) cases, scleral tear in 2(1%) cases. According to Odebode et al[6] the soft-tissue injuries to the globe and adnexa were the most common finding, observed in 29(12.89%) patients, and orbital fracture with rupture of the eye was present in 2(0.89%) patients. Periorbital ecchymosis was the most frequent soft tissue injury, recorded in 17 patients (7.56%), chemosis in 20 patients (8.89%), subconjuctival haemorrhage in 21 patients (9.33%), ten cases had lid laceration, i.e (4.44%), corneoscleral laceration in five cases (2.22%), haemorrhages on the retina were observed in 2 patients (8.89%), and commotio retinae in 3(1.33%) patients. Various other neuro-ophthalmic complications observed were atypical pupil reaction in 12 (5.33%), partial or complete ptosis in 10 patients (4.44%), and lagophthalmos in 1 patient (0.44%). In a study by Ramachandran. S et al[9], 60 patients with ocular trauma were included, 31 out of sixty cases had head injury in association of the eye trauma , severity of the head injury was categorized by GCS score, and the observations made were, 25 had mild head injury, moderate head injury was seen in two cases and 4 patients had severe injury. The most common eye finding due to head trauma was ecchymosis of lids and periorbitaledema,i.e 58%, followed by subconjuctival haemorrhage.

Observations of the undertaken study, correlate with the findings of other studies.

Our study showed, 3 patients with pupillary abnormalities, i.e 3.52% and 1.17% patients had traumatic optic neuropathy.In the study by Masilaet al[5] 39 eyes had atypical pupil reaction. Two patients had third cranial nerve palsy. According to Kulkarni et al[7], involvement of pupil was present in 10/200 cases (5%) and it was the most frequently occurred neuro-ophthalmic sign. Sixth cranial nerve palsy was recorded in 2% of head injury cases. Traumatic optic neuropathy is seen in 0.5% of cases and third nerve palsy is seen in 1.5% of the cases.According to Odebode et al[6] involvement of the sixth cranial nerve was the most common ocular motor nerve palsy, which was present in 8 patients, followed by third and fourth cranial nerve palsies, which were obsereved and documented in six cases each. Various other neuro-ophthalmic complications recorded were atypical pupil reaction in 12, partial or complete ptosis in 10, and lagophthalmos in 1 case. According to this study, 72.94% cases with mild head injury had trauma to ocular adnexa, and 18.82% patients had anterior segment manifestations.

Severe head trauma and posterior segment findings had constant relation, without any exception. Severe head trauma was also positively correlated with the neuro-ophthalmic findings. According to Odebode et al[6], severe head injury patients had only soft tissue injury to the eye, adnexa and periorbital region, 50% of the times. 43.75% patients with severe head injury had neuro-ophthalmic manifestations in association with damage to ocular soft tissue, adnexa and periorbital region,as well. Patients with extreme severity of head injury had rupture of the globe and fracture orbit as well as neuro-ophthalmic

manifestations and soft tissue damage to eye, adnexa and periorbital region in 6.25 % cases. According to Kulkarni et al[7], 82.7% patients with less severe head injury had eye involvement of no neurological significance, including unilateral and bilateral ecchymosis 49 (32.67%), subconjunctival haemorrhages 38 (25.33%), orbital margin fractures in 12 (8%), proptosis in 6 (4%), blow out fractures of the orbit in four (2.67%), macular oedema in three (2%) cases, unilateral traumatic mydriasis, lacrimal gland prolapse and scleral and corneal tears in 2(1.33%) cases each, and hyphaema and haemorrhage in vitreous in one (0.7%) case each. 82.8% of patients of moderately injured head had ocular involvement. 9(31.03%) patients had pupillary signs. Papilloedema was observed in three (10.34%) cases, lateral rectus palsy in 4(13.79%) cases, ecchymosis and orbital margin fractures in 2(6.9%) cases each, retinal haemorrhage, macular oedema, ptosis, and traumatic optic neuropathy in 1(3.45%) case each. 90.48% patients of extremely severe head injury had involvement of eye. 2 (9.52%) patients had pupillary involvement. Papilloedema was seen in 8 (38.1%) cases, orbital fractures were observed in six (28.57%) cases and ecchymosis was seen in 3(14.29%) cases.The findings of these studies largely correlate with the findings of our study. In this study, visual acuity greater than CF 3m was present in 59 cases, less than CF 3m in 18 cases and vision was unrecordable in 8 cases at presentation. In the study done by Masila et al[5], 70.8% eyes had the normal visual acuity, 21.90% had visual impairment, and 2.4% had severe visual impairment.

These findings correlate with our study.

At 1 week, 26 patients were lost to follow up and 3 patients died. Among the 56 patients who were followed up, commonest ocular findings were periorbital oedema and ecchymosis, documented in 10 patients each (17.85%), followed by SCH (16.07%) and in 1 patient optic nerve atrophy secondary to trauma was seen. And the remaining twenty-six subjects had no ocular findings.

All cases with lids and adnexa manifestations at 1 week follow up had head injury categorized as mild. Anterior segment manifestations patients had mild head injury at 1 week of follow up. Severe head injury with posterior segment findings, were recorded in one patient.Visual acuity less than 6/60, was recorded in one patient at the first follow up visit. Others had visual acuity greater than 6/60 in both eyes. At 4 weeks of follow up, we lost the follow up for 8 more patients, and 1 more patient died. So the follow up was done for 47 patients and 1 patient had ecchymosis and all other patients had no ocular finding. All patients examined at 4 weeks had GCS score of 15. All patients at 4 weeks had vision better than 6/60. At 6 weeks, only 45 patients were followed up, and none of them had any ocular finding. All of them had GCS score of 15. All followed up cases at 6 weeks had their vision greater than 6/60.

So, the observation made was that at various follow up visits, patients had improvement in the ocular manifeatations of the head injury and of the direct trauma to the eye. There was an improvement in the GCS score as well.

Conclusion

With the inferences drawn from the study we conclude that, there can be various ocular manifestations in closed head injury patients. The correlation of the severity of head injury with the posterior segment and neuro-ophthalmic manifestations, showed that the more severe form of head injury is related with severe ocular findings and thus resulting in poorer neurological and visual outcomes.

Therefore, a detailed ocular assessment during the first presentation in all cases of head injury patients is mandatory as it helps in better management and the final outcome could be improved with better diagnosis and management.

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Comparison of Surgically Induced Astigmatism between Straight and Frown Incisions in Manual Small Incision Cataract Surgery

Sandhya R[1], Nithiya Joe Babu[2]

Abstract

The type of incision is the major contributory factor to the postoperative astigmatism. Different incisions may cause different degrees of astigmatism. It becomes imperative to compare the SIA caused by the commonly used incisions like straight and frown incisions. *Objectives:* To evaluate and document the best corrected visual acuity and surgically induced astigmatism in patients undergoing manual small incision cataract surgery by straight incision and frown incision. To compare the surgically induced astigmatism following straight and frown incision. *Materials and Methods:* For this prospective study a total of 96 eyes fulfilling the inclusion criteria were selected and allotted into two groups by simple randomization technique. Group1 – 48 patients – underwent MSICS with straight incision. Group2 – 48 patients – underwent MSICS with frown incision. This study was conducted in the department of ophthalmology at R. L. Jalappa Hospital and Research, Kolar attached to Sri Devaraj Urs Medical College, between January 2018 and May 2019. Post-operative visual acuity was assessed with Snellen's chart. surgically induced astigmatism was calculated using SIA calculator version 2.1. *Results:* The uncorrected visual acuity of group 2 was better when compared to group 1. 13(27.1%) patients achieved postoperative emmetropia in straight incision group while 24 (50%) patients achieved post operative emmetropia in frown incision group. All patients achieved a BCVA of ≥ 6/18. The mean magnitude of preoperative astigmatism in straight incision was 1.26± 0.92 D and in frown incision was 0.98 ± 0.83 D. The mean magnitude of postoperative astigmatism in straight incision was 1.52±1.17 D and in frown incision was 0.99 ± 0.82D and was found to be statistically significant, p= 0.012. The centroid of SIA for straight incision was 1.4x1° with a coherence of 90% and the centroid of SIA for frown incision was 0.62x2° with a coherence of 70%. *Conclusion:* The visual outcome of frown incision group was slightly better than the visual outcome in straight incision group. All patients achieved a BCVA ≥ 6/18. The difference in visual acuity was not found to be statistically different. The SIA of straight incision was significantly more than that of frown incision. (p=<0.001).

Keywords: SIA; SICS; Postoperative astigmatism; Straight incision; Frown incision; MSICS.

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Introduction

An estimated 36 million people are blind, three quarters of which is caused by senile cataract.[1] In India and in other developing countries senile cataract is the leading cause of avoidable blindness.

Author Affiliation: [1]Professor and HOD, [2]Junior Resident, Department of Ophthalmology, Pgwomens Hostel, SDUMC, Kolar 563101, Karnataka, India.

Corresponding Author: Nithiya Joe Babu, Department of Ophthalmology, Pgwomens Hostel, SDUMC, Kolar 563101, Karnataka, India.

E-mail: njoebabu@gmail.com

Manual small incision cataract surgery (MSICS) is the most widely used method for cataract surgery in developing countries.[2] The factors influencing the visual outcome in manual small incision cataract surgery include, biometry, grade of cataract, post-operative astigmatism and surgeon's factor.[3] One of the important factors influencing visual outcome is surgically induced astigmatism (SIA). Surgeons aim at achieving post-operative emmetropia by reducing SIA which can contribute to a low visual outcome. SIA can be controlled by proper analysis of keratometric values pre-operatively, planning the incision size, type of incision and site of incision.[4]

The type of incision is a very important contributory factor to the post-operative astigmatism. Different incisions may cause different degrees of astigmatism. It becomes imperative to compare the SIA caused by the commonly used incisions like straight and frown incisions. Studies done comparing the SIA of frown and straight incisions gives a conflicting picture.[4,5] Studies give varied results as regards the post-operative astigmatism. Thus, a comparative study between frown incision and straight incision in manual small incision cataract surgery (MSICS) with posterior chamber intraocular lens implantation (PCIOL) is being conducted to facilitate the patient's post-operative vision. In this study we aim to evaluate and compare the uncorrected visual acuity and best corrected visual acuity between straight and frown incision and to compare the SIA between straight and frown incision using SIA calculator 2.1.

Materials and Methods

Source of Data

For this prospective study a total of 96 eyes fulfilling the inclusion criteria were selected and allotted into two groups by simple randomization technique (48 eyes in each group). This study was conducted in the department of ophthalmology at R. L. Jalappa Hospital And Research, Kolar Attached To Sri Devaraj Urs Medical College, between January 2018 and May 2019. All patients between the age group of 40–70 years undergoing MSICS with PCIOL implantation were included in this study. Those with corneal disorders like corneal opacity, degenerations and dystrophies, high myopia with thin sclera, primary or secondary glaucoma, scleral disorders like scleromalacia, scleritis, subluxated lens, history of previous ocular surgeries, traumatic cataract, hypermature cataract were excluded from our study.

Method of Collection of Data

All patients in this study underwent similar protocol. Informed consent was taken for all patients who participated in this study as per the standard protocol. Standard clinical examination which included recording of visual acuity with Snellen's chart, Goldmann Applanation tonometry, slit lamp examination, lacrimal syringing, and fundus evaluation were performed for all patients. Routine blood investigations were done for all participants in this study which included CBC, RBS, HIV, HBsAg, blood urea, serum creatinine.

Preoperative keratometry was measured by using a standard calibrated manual Bausch and Lomb keratometer. Axial length was measured using standard Ultrasound A-Scan, IOL power calculation is done using Sanders-Retzlaff-Kraff formula II (SRK II).

Similar protocol for preoperative preparation was done for all patients. All patients received Xylocaine test dose, oral tab ciprofloxacin 500mg twice daily and ciprofloxacin 0.3% eye drops 4 times per day one day before the surgery. Before the start of surgery, the pupil was dilated with a combination of tropicamide 0.8% with phenylephrine 5% drops. Flurbiprofen 0.03% drops was used to maintain mydriasis.

All patients underwent MSICS within the bag PC IOL implantation by a single surgeon. Out of the 96 patients in the study, 48 each patients were randomly divided into Group 1 and 2. The straight incision of 6mm which was 2mm from the superior limbus was used in Group 1 and a frown incision of 6mm with the apex of the incision 1.5 mm from the superior limbus and ends of the two limbs 4mm from the limbus was used in Group 2.

Similar protocol for postoperative care was followed for all patients. Post operative medications included tab ciprofloxacin 500mg given orally twice daily, a combination of ciprofloxacin 0.3% and dexamethasone 0.1% eye drops used for 6 weeks in a tapering dose. Postoperative corneal oedema was treated with sodium chloride 5% eye drops 4 times per day. Cycloplegics like Homatropine 2% and antiglaucoma medications like timolol 0.5% drops were given when required.

Postoperative follow up examination was conducted on day 1, 1st week, 4th week and 6th week. At each visit uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), careful slit lamp examination and keratometrywere performed.

The magnitude of astigmatism was classified according to Holmstrom's gradation.[6]

- No astigmatism, when <0.25D.
- Non-significant, when it is ≥0.25 and <1.0D.
- Significant, when it is ≥1.0D and <2.0 D.
- High, when it is ≥ 2 D.

The axes of astigmatism were divided into 3 classes.

- With the rule (minus cylinder at 180^{o} ± 20^{o} or plus cylinder at 90^{o} ± 20^{o}).

- Against the rule (minus cylinder at $90^o \pm 20^o$ or plus cylinder at $180^o \pm 20^o$).
- Oblique.

SIA calculator version 2.1 by Dr Saurabh Sawhney and Dr Aashima Aggarwal was used to calculate the surgically induced astigmatism.[7] The keratometric values were converted to the plus cylinder formats to obtain the requires preoperative and post-operative astigmatism. This data was entered in the SIA calculator which analysed the data using the Cartesian coordinate analysis. It generates an x and y coordinate for each value of astigmatism using the formulae x=a cos 2p and y=a sin 2p, where a represents the magnitude of astigmatism and y represents the axis of steeper meridian. X_{pre} was subtracted from X_{post} and Y_{pre} was substracted from Y_{post} to obtain X_{SIA} and Y_{SIA}.

Magnitude of SIA was obtained by using the formula SIA magnitude=$(X_{SIA}^2+Y_{SIA}^2)$. The angle of SIA θ was obtained by the formula θ=0.5 x arctan(Y_{SIA}/X_{SIA}). The centroid value was obtained by finding the mean of the preoperative and postoperative astigmatism in X and Y format. $X_{mean(pre)}$ was substracted from $X_{mean(post)}$ and $Y_{mean(pre)}$ was substracted from $Y_{mean(post)}$ to obtain $X_{meanSIA}$ and $Y_{meanSIA}$.

The magnitude of centroid was then obtained by using the formula, magnitude of centroid of SIA=$[X_{meanSIA}^2 + Y_{meanSIA}^2]^{1/2}$. The angle of the centroid value was obtained by θ = 0.5 x arctan $(Y^{meanSIA}/X_{meanSIA})$. Similarly, the centroid of preoperative and postoperative astigmatism was also be obtained. All centroid values thus obtained were in the plus cylinder format.

Astig MATIC, an application which uses Alpins vector analysis method was used to obtain single angle vector plots of the SIA vector.[8,9]

Statistical Analysis

Collected data was entered into an Excel spreadsheet with all the quantitative measures like preoperative astigmatism, postoperative astigmatism, SIA was presented by mean and standard deviation with confidence interval and qualitative data by proportions. Student t test/Mann Whitney U test was used to compare the difference of means. Chi square test was used for testing difference in proportion. Simple linear regression was used to find out the difference in astigmatism and best corrected visual acuity between the two groups. p value less than or equal to 0.05 was considered as statistically significant.

Results

Our study consisted of 96 subjects of which 59 (61.5%) were females and 37 (38.5%) were males. Group 1 consisted of 29 females (60.4%) and 19 males (39.6%) and group 2 consisted of 30 females (62.5%) and 18 males (37.5%) (Table1).

Table 1: Gender Group Crosstabulation.

Gender	Group		Total
	Straight Incision (group 1)	Frown Incision (group 2)	
Females	29(60.4%)	30(62.5%)	59(61.5%)
Males	19(39.6%)	18(37.5%)	37(38.5%)
Total	48(100%)	48(100%)	96(100%)

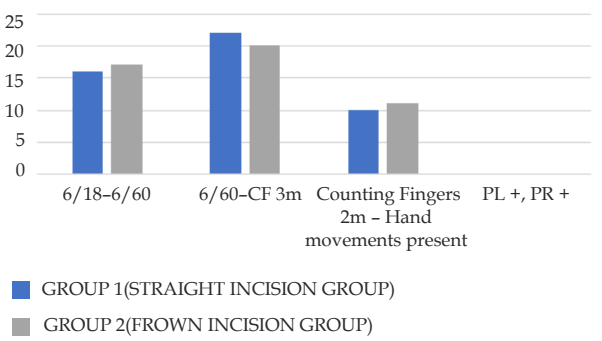
Preoperatively, majority of patients, 22(46%) patients in group 1 and 20(42%) patients in group 2 had UCVA between 6/60 and CF 3m. 16(33%) patients in group 1 and 17(35%) patients in group 2 had UCVA between 6/18 and 6/60. 10(21%) patients and 11 (23%) patients had visual acuity between CF 2m and HM+. There was no difference in the preoperative UCVA between both the groups (Table 2, Graph 1).

Table 2: Comparison of preoperative uncorrected visual acuity between straight and frown incision.

Preop Ucva	Group 1 (Straight Incision Group)		Group 2 (Frown Incision Group)	
	Number of Patients	%	Number of Patients	%
6/18–6/60	16	33%	17	35%
6/60–CF 3m	22	46%	20	42%
CF 2m – HM +	10	21%	11	23%
PL +, PR +	–	–	–	–
Total	48	100%	48	100

%– PercentagePL– Perception of light
CF– Counting FingersPR– Projection of rays
HM– Hand movements

Graph 1: Bar diagram showing comparison of preoperative uncorrected visual acuity between both the groups.



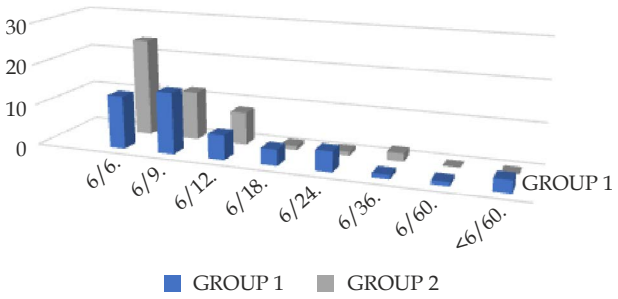
13(27.1%) patients achieved postoperative emmetropia in straight incision group while 24 (50%) patients achieved postoperative emmetropia in frown incision group. 15(31.2%) patients from group 1 and 12 (25%) patients achieved 6/9 vision postoperatively. 6(12.5%) patients and 8(16.7%) patients from group 1 and 2 respectively achieved 6/12 vision. 4 patients had 6/18 vision and 5 patients had 6/24 vision from group 1. Only 1 patient each in group 2 had 6/18 and 6/24 vision postoperatively. 1 patient had a vision of 6/36 in group 1. and 6/60 in group 1. 3 patients in group 1 had a vision less than 6/60 in group 1. All patients in group 2 achieved UCVA more than 6/60. 2 patients had 6/36 vision in group 2 (Table 3, Graph 2).

Table 3: Comparison of postoperative uncorrected visual acuity between straight and frown incision.

Postoperative Ucva	Group 1		Group 2	
	N	%	N	%
6/6	13	27.1%	24	50%
6/9	15	31.2%	12	25%
6/12	6	12.5%	8	16.7%
6/18.	4	8.3%	1	2.1%
6/24.	5	10.4%	1	2.1%
6/36.	1	2.1%	2	4.1%
6/60.	1	2.1%	–	–
<6/60.	3	6.3%	–	–
Total	48	100%	48	100%

UCVA – Uncorrected visual acuity
N– Number of patients
%– Percentage

Graph 2: Bar diagram showing comparison of postoperative uncorrected visual acuity between straight and frown incision.



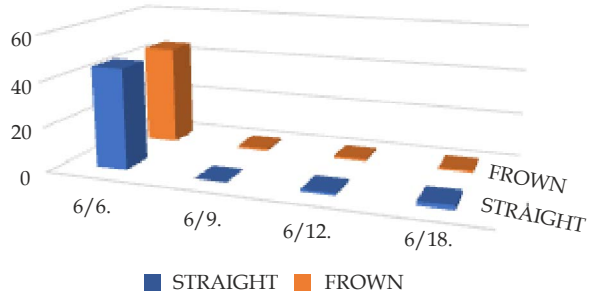
45 (93.7%) patients in group 1 and 45 (93.7%) patients in group 2 achieved a BCVA of 6/6. 1 patient had 6/12 and 2 patients had 6/18 BCVA in group 1. One patient each in group 2 achieved BCVA of 6/9, 6/12 and 6/18 (Table 4, Graph 3).

Table 4: Comparison of postoperative best corrected visual acuity between straight and frown incision.

Postoperative Bcva	Group 1		Group 2	
	N	%	N	%
6/6	45	93.7%	45	93.7%
6/9	–	–	1	2.1%
6/12	1	2.1%	1	2.1%
6/18	2	4.2%	1	2.1%
Total	48	100%	48	100%

BCVA – Best Corrected Visual Acuity
N– Number of patients
%– Percentage

Graph 3: Bar diagram showing comparison of postoperative best corrected visual acuity between straight and frown incision.



Preoperatively in group 1, 2(4.1%) patients had no astigmatism, 33(68.75%) patients had with-the-rule astigmatism (WTR), 10(20.83%) patients had against-the-rule astigmatism (ATR) and 3(6.25%) patients had oblique astigmatism. 19(39.58%) had non-significant astigmatism, 14(29.17%) had significant astigmatism and 13(27.08%) patients had highly significant astigmatism in group 1. In group 2,3(6.25%) patients had no astigmatism, 24(50%) patients had WTR astigmatism, 13(27.08%) patients had ATR and 8(16.67%) patients had oblique astigmatism. 23(47.9%) had non-significant astigmatism, 16(33.33%) had significant astigmatism and 6(12.5%) patients had highly significant astigmatism in group 2.

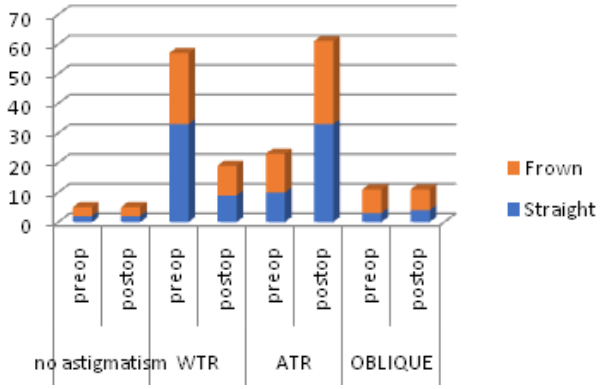
The majority of patients in both the groups had WTR astigmatism preoperatively.Among the patients with WTR astigmatism in either groups, most people had nonsignificant astigmatism (Table 5).

Table 5: Preoperative astigmatism.

Incision	No Astigmatism	WTR			ATR			Oblique			Total
		Non Sig	Sig	High Sig	Non Sig	Sig	High Sig	Non Sig	Sig	High Sig	
Straight (group 1)	2	14	12	7	5	2	3	–	–	3	48
Frown (group 2)	3	13	9	2	7	5	1	3	2	3	48
Total	5	29	21	9	12	7	4	3	2	6	96

Postoperatively in group 1, 2(4.1%) patients had no astigmatism, 9(18.75%) patients had WTR astigmatism, 33(68.75%) patients had ATR astigmatism and 4(8.3%) patients had oblique astigmatism. 15(31.25%) had non-significant astigmatism, 16(33.3%) had significant astigmatism and 15(31.25%) patients had highly significant astigmatism in group 1. In group 2, 3 patients had no astigmatism, 10(20.8%) patients had WTR astigmatism, 28(58.33%) patients had ATR astigmatism and 7(14.58%) patients had oblique astigmatism. 22(45.83%) had non-significant astigmatism, 17(35.4%) had significant astigmatism and 6(12.5%) patients had highly significant astigmatism in group 2. (Table 6).

Graph 4: Comparison of type of preoperative and postoperative astigmatism in straight and frown incision.



The majority of patients in both the groups had WTR astigmatismpreoperatively. Among the patients with WTR astigmatism in both groups, most people had nonsignificant astigmatism while highly significant WTR astigmatism was nil in both groups. In group 1 the number of patients with highly significant ATR astigmatism was more while it was less in group 2. (Table 6, Graph 4)

The mean magnitude of SIA in straight incision was 1.69 ± 0.82 D and in frown incision was 0.61 ± 0.35 D. The mean axis of SIA in straight incision was 87.88± 60.94 and in frown incision was 83.75± 62.37.

The mean difference between the SIA magnitude of straight and frown was found to be statistically significant, p=<0.001, while the mean SIA axis when compared between both the groups was not found to be statistically significant=0.744. (Table 7)

Table 8: Results of cartesian coordinates-based analysis of group 1 (straight incision)

	Mean ±SD		Centroid	Coherence (%)
	X Value	Y Value		
Preoperative Astigmatism	–0.65±1.16	0.16±0.67	0.67X83°	56
Postoperative Astigmatism	0.75±1.35	0.2±0.67	0.77X7°	59
Surgically Induced Astigmatism	1.4±0.91	0.03±0.48	1.49X1°	90

The centroid value (mean SIA vector) of preoperative astigmatism in group1 with straight incision postoperative astigmatism is 0.67x 83° with a coherence of 56% and that of group 2 is 0.77 x 7° with a coherence of 59%. The centroid of SIA for straight incision is 1.49x1° with a coherence of 90%(Table 8, graph 5).

Table 9: Results of cartesian coordinates-based analysis of group 2 (frown incision).

	Mean±SD		Centroid	Coherence (%)
	X Value	Y Value		
Preoperative Astigmatism	–0.23±1.0	0.23±0.75	0.33X67°	33
Postoperative Astigmatism	0.39±1.01	0.26±0.72	0.47X17°	45
Surgically Induced Astigmatism	0.62±0.76	0.03±0.39	0.62X2°	70

The centroid value of preoperative astigmatism in group 2 with frown incision is 0.33X67° with

Table 6: Postoperative astigmatism.

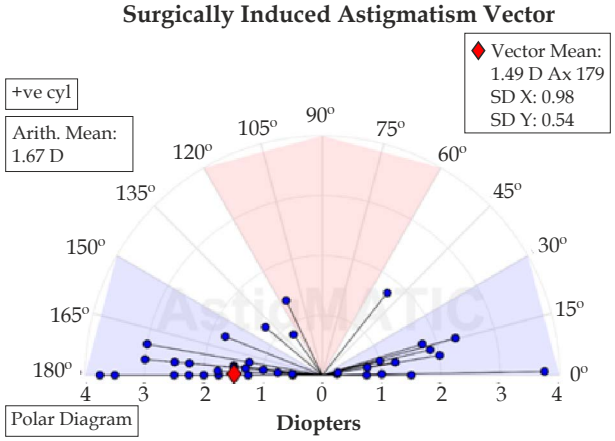
Incision	No Astigmatism	Wtr			Atr			Oblique			Total
		Non Sig	Sig	High Sig	Non Sig	Sig	High Sig	Non Sig	Sig	High Sig	
Straight (group 1)	2	5	4	–	10	11	12	–	1	3	48
Frown (group 2)	3	7	3	–	13	12	3	2	2	3	48
Total	5	12	7	–	23	23	15	2	3	6	96

Table 7: Comparison of surgically induced astigmatism between straight and frown incision.

	Group	N	Mean	Std. Deviation	Std. Error Mean	P-Value
SIA Magnitude	Straight Incision	48	1.688333	0.8180447	.1180746	<0.001
	Frown Incision	48	0.6058	0.3502	0.0505	
SIA Axis	Straight Incision	48	87.88	60.941	8.796	0.744
	Frown Incision	48	83.75	62.37	9.003	

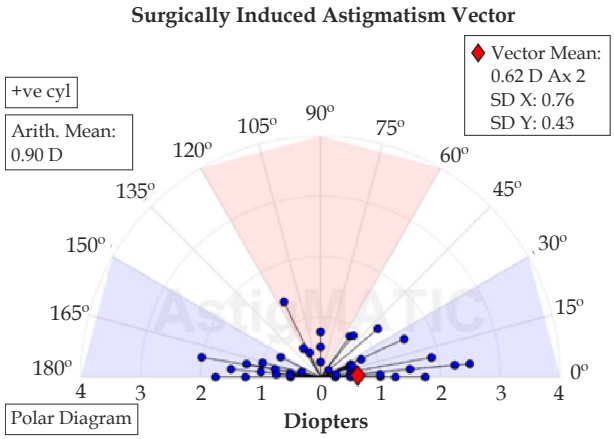
a coherence of 33% and that for postoperative astigmatism is 0.47X17° with a coherence of 45%. The centroid of SIA for frown incision is 0.62X2°with a coherence of 70% (Table 9, Graph 6).

Graph 5: Single angled polar plot showing SIA vector in straight incision (group 1).



The single angled polar plots shows clustering of coordinates around the centroid value.

Graph 6: Single angled polar plot showing SIA vector in frown incision (group 2).



Discussion

The mean age of subjects in group 1 was 64.2 years and in group 2 was 63.5 years. In Group 1 and Group 2, majority of subjects were in the age group 66 to 70 years (45.8% and 43.8% respectively). There was no significant difference in age distribution between two groups.

Group 1 consisted of 29 females (60.4%) and 19 males (39.6%). Group 2 consisted of 30 females (62.5%) and 18 males (37.5%). There was no significant difference in gender distribution between two groups.

In Group 1, 56.2% underwent surgery for right eye and 43.8% underwent surgery for the left eye. In Group 2, 58.3% underwent surgery for right eye and 41.7% underwent surgery for the left eye. The majority of patients in either group underwent operation for the right eye. There was no statistical significance in the eye operated between both the groups.

All patients were followed up for a period of 6 weeks postoperatively. The UCVA of group 2 was better when compared to group 1. 13(27.1%) patients achieved postoperative emmetropia in straight incision group while 24 (50%) patients achieved postoperative emmetropia in frown incision group. All patients achieved a BCVA of ≥ 6/18. the visual outcome following frown incision was observed to be better than that of straight incision, but it was not found to be significant.

The mean magnitude of preoperative astigmatism in straight incision was 1.26±0.92 D and in frown incision was 0.98±0.83D. There was no significant statistical difference in both the groups.

Study by Jauhari N, Chopra D et al. gave a mean SIA of -1.08±0.67D and –0.96± 0.71 for straight and frown incisions respectively.[5] Comparatively, our study gave a lesser SIA with frown incision and a larger SIA with straight incision. The arithmetic mean of SIA in our study was 1.69±0.82D for straight incision while it was 0.61±0.35D for frown incision. The difference in the mean SIA between both the groups were found to be statistically significant, p=<0.001

SIA in our study was calculated using SIA calculator which is an analysis based on cartesian coordinates. It allows the analysis of a large number of data accurately. SIA calculator considers not only the magnitude of astigmatism but also the axes of astigmatism. The arithmetic mean may not give an accurate prediction of the actual average as it ignores the axes of astigmatism. Centroid is the mean SIA vector and is often a better predictor of the mean of an astigmatic vector.

In our study, the centroid values of preoperative and postoperative astigmatism in group 1 with straight incision was 0.67 x 83° and 0.77 x 7° respectively. The centroid values of preoperative and postoperative astigmatism in group 2 with frown incision was 0.33 x 67° and 0.47 x 17° respectively.

Arthur E et al., studied the postoperative corneal astigmatism and the SIA following superior approach MSICS in patients with preoperative ATR astigmatism. He analysed the SIA using

Cartesian coordinates-based analysis. Centroid values were found to be 1.42 × 179°, 2.48 × 0°, 1.07 × 1° for preoperative astigmatism, postoperative astigmatism and SIA respectively.[10]

Coherence is an indicator of tightly clustered data set. When the coherence value is low, it means that the SIA vectors are more scattered and they cancel each other out. Therefore, when the coherence value is high, the centroid is more representative of the group as a whole and it also shows that the predictability of the SIA for the particular incision is high for the surgeon.[11]

The centroid of SIA was lesser in frown incision being 0.67 x 2° with 70% coherence when compared to straight incision which was 1.4x1° it was also seen that the coherence of the SIA in straight incision was 90%, showing that the SIA was a tightly clustered set of points and therefore more predictable. However, this might vary between surgeons. A study by Gokhale NS, Sawhney S showed that the mean SIA for frown incision with superior site to be 1.28 x 29°.

The highest value of SIA obtained for straight incision was 3.75 x 90° and for frown incision was 1.88 x 10° and the lowest values were 0.25 x 175° and 0.03 x 44° for straight and frown incisions respectively.

The majority of patients in both the groups had with-the-rule astigmatism preoperatively.

Majority of patients in both the groups had ATR astigmatism postoperatively. Studies conducted previously has reported ATR shift in astigmatism postoperatively. Our study is consistent with this finding.

Among the patients with WTR astigmatism in both groups, most people had nonsignificant astigmatism while highly significant WTR astigmatism was nil in both groups. In group 1 the number of patients with highly significant ATR astigmatism was more while it was less in group 2.

Any incision lying in the incisional funnel is astigmatically neutral. Frown incision lie entirely within this tunnel. This might be the cause of less astigmatism compared to straight incision in our study.

Conclusion

The visual outcome of frown incision group was slightly better than the visual outcome in straight incision group. The difference in visual acuity was not found to be statistically significant.

The SIA of straight incision was more than that of frown incision. The mean magnitude of SIA was statistically significant but mean axis of SIA was not found to significant.

The use of both straight and frown incision in superior site SICS led to ATR shift postoperatively.

All patients who participated in this study achieved a BCVA of ≥ 6/18.

Multicentric randomized controlled studies with similar objectives may be required for more accurate analysis.

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Original Article

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Comparative Study on Toric Intraocular Lens vs Peripheral Corneal Relaxing Incisions to Correct Astigmatism in Eyes Undergoing Cataract Surgery

Kamaljeet Singh[1], Vikas Agrawal[2], Satya Prakash Singh[3], Kshama Dwivedi[4]

Abstract

Purpose: To compare Toric IOLs and Peripheral corneal relaxing incisions for correcting pre-operative astigmatism in eyes undergoing cataract surgery. *Setting:* M. D. Eye Hospital, Regional Institute of Ophthalmology, Prayagraj, India. *Design:* Prospective Observation study. *Method:* Eyes with astigmatism of ≥1.5 D undergoing cataract surgery either with the rule astigmatism (WTR) or against the rule astigmatism (ATR) confirmed by corneal topography between November 2018 to October 2019 were included in the study. The same surgeon performed phacoemulsification/SICS with PCRI to reduce pre-existing astigmatism. *Result:* In our study 35 eyes of 35 patients were included. 10 eyes of 10 patients underwent Toric IOL implant who had >2.00 D of astigmatism & 25 eyes of 25 patients had mild astigmatism and underwent SICS with PCRI. Patients were followed up regularly till 10 weeks. In Toric IOL implant group 90% patients of moderate to higher order astigmatism had BCVA in the range of 6/9–6/6. Eyes underwent SICS with PCRI 60% of the patients had BCVA 6/9-6/6. Only few patients required cylindrical glasses post-operatively. *Conclusion:* PCRI cannot be used for moderate to high astigmatism. Spectacle dependence of PCRI group was more than Toric IOL group. Although cost wise PCRI is better option over Toric IOL implant for correcting pre-operative astigmatism.

Keywords: With the Rule (WTR) astigmatism; Against the rule (ATR) astigmatism; Peripheral corneal relaxing incision (PCRI).

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Introduction

Astigmatism accounts for approximately 13% of all refractive errors.[1,2] Over 20% of the patients attending for cataract surgery have >1.5D of astigmatism, 8% have >2.0D and 2.6% have >3.0D astigmatism.[3-6] Uncorrected astigmatism of >0.75D can cause visual blurring, ghosting of images or halos.[7,8]

Every procedure performed on the cornea induces a certain amount of astigmatism, even phacoemulsification for cataract surgery. Corneal incisions made during cataract surgeries reduce corneal power on the meridian of incision.

With the advancement in the cataract surgery from ICCE to ECCE to Phacoemulsification; visual outcome to the patients increases dramatically. Now this is the era of cataract surgery with specially designed IOLs like Toric IOLs and procedures like peripheral corneal relaxing incisions (PCRIs) or limbal relaxing incisions (LRIs) to significantly reduce the post operative astigmatism in desired way.

In this modern era of cataract surgery where the expectations of the patient are very high for the outcome of the surgery i.e. in the form of increased visual acuity, good color contrast sensitivity, reduction of glare and spectacle independence etc.[12] The refractive astigmatism is sum of both corneal

Author Affiliation: [1]Professor and Head of Department, [2]JR-3, , [3]Principal and Director, [4]Associate Professor, Department of Ophthalmology, M.L.N Medical College, R.I.O. Prayagraj, India.

Corresponding Author: Vikas Agrawal, JR-3, Department of Ophthalmology, M.L.N. Medical College, R.I.O. Prayagraj, India.

E-mail: vikkyagrawal02@gmail.com

astigmatism as well as lenticular astigmatism, but after cataract surgery lenticular component abolishes, so if we handle corneal astigmatism during the cataract surgery better outcomes of the cataract surgery in the form of reduced glare and spectacle independence can be achieved post operatively.

So, astigmatism during the cataract surgery can be corrected by following methods:[13]

1. Selective positioning of phaco incision
2. Peripheral relaxing incisions (Limbal relaxing incision and corneal relaxing incision.)
3. Toric IOL implant.

All these methods are good in context of reducing preoperative astigmatism; but selective positioning of incisions[14] and peripheral relaxing incisions are useful for correcting only mild corneal astigmatism whereas toric IOLs are specially designed lenses which can correct very high order astigmatism (upto 12D).[15]

The current study is a prospective study to compare the toric IOL vs PCRI to correct astigmatism in eyes undergoing cataract surgery.

Aims and Objectives

1. To compare the Toric Intra Ocular Lenses vs Peripheral corneal relaxing incisions to correct astigmatism in eyes undergoing cataract surgery.
2. To determine the degree of astigmatism pre-operatively in patients undergoing cataract surgery.
3. To record the final refractive outcome of the patient after the surgery.

Methods

This prospective observational study was conducted at Regional institute of Ophthalmology (M. D. Eye Hospital) PrayagRaj between December 2018 to November 2019. This study was approved by ethical committee of M.L.N. Medical College, PrayagRaj. The participants of this study were recruited from the OPD of Deptt. Of Ophthalmology, RIO PrayagRaj.

They were given a patient information and consent sheet and given an opportunity to read and discuss participation with their family members.

Participants were free to talk to the co-ordinator of the study as well as they can withdraw at any point of time.

Inclusion Criteria

1. Patients of both genders.
2. Patients of age 40– 70 yrs.
3. Pre operative regular astigmatism > 1.5D
4. Pre-operative mydriasis of more than 6.0 mm.
5. Otherwise healthy retina with normal fundus.
6. If diabetic, then <5 years of disease and HbA1c <6.0 (good glycemic control).
7. Patients with grade I-IV cataract were considered in this study and grade IV cataract were taken for SICS with PCRI because it is difficult to perform phacoemulsification in grade IV cataract.
8. Mostly low to moderate astigmatism patients were considered for SICS with PCRI whereas higher order astigmatism were implanted with toric IOL if cataract grade was ≤ grade III.

Exclusion Criteria

1. Patients having preoperative astigmatism of <1.5 D or irregular astigmatism.
2. Patients having corneal pathology or history of penetrating trauma or history of penetrating keratoplasty.
3. Patients having optic atrophy.
4. Retinal detachment and other retinal pathology.
5. Any history of previous ocular surgery.
6. Immunocompromised patients having HIV, HBV or HCV.
7. Uncontrolled diabetes ; > 5 years of disease or > 6.0 HbA1c (poor glycemic control).

Preoperative Evaluation

Pre operatively all patients underwent general and ophthalmic evaluation and pre-operative work up for cataract surgery which includes:

- Complete relevant history was taken including name, age, sex, residence and occupation.
- Preoperative uncorrected (UCVA) and best corrected visual acuity (BCVA) were recorded.
- Refraction and Assessment of spectacle correction if required.
- Slit lamp examination was done to look out any corneal, anterior chamber or iris pathology.

- NCT/ Applanation tonometry for recording IOP
- Intraocular pressure was recorded to rule out glaucoma
- Fundus examination of both eyes was done by direct and indirect ophthalmoscope to rule out fundus pathology.
- Keratometry reading were be recorded by the help of Bausch & Lomb manual keratometer.
- Corneal topography was done with the help of Tomey topographer.
- IOL power calculation was done with A-scan biometry.

Sampling Technique

A total 35 patients met the inclusion criteria. The sampling technique was non-probability convenience sampling and the patients divided into two groups – Group A and Group B.

Group A: included 25 eyes of 25 patients, which underwent SICS (Temporal or Supero temporal incision) with 1 peripheral corneal relaxing incision (PCRI).

Group B: included 10 eyes of 10 patients, which underwent toric IOL implantation.

All the surgeries either PCRI or Toric IOL implantation in all eyes were performed by experienced senior surgeon Prof. K.J. Singh of the institute.

Surgical Procedure

Anterior keratometric data was obtained by Bausch & Lomb manual keratometer and if significant regular astigmatism was found then amount of astigmatism and meridian was confirmed by topography (Tomey Topographer). A minimum of 3 images were taken and best was saved for data analysis. All participants were underwent their biometry on IOL Master (Carl Zeiss Meditec, Germany).

A single experienced right handed surgeon (Prof. K. J. Singh) performed all cataract surgeries under peri-bulbar anesthesia. On the day of operation eye was again fully dilated and examined thoroughly and marking on slit-lamp in upright position was done at 0 and 180. The participant was asked to fixate on a distance target and requested not to blink during the marking procedure.

a) *PCRI procedure:* A single PCRI was placed on the limbus prior to the commencement of the cataract surgery using 0 and 180 ink marks as reference. After draping the patient a standard 600 micron PCRI was made close to the limbus with the help of diamond knife.

   A 5.5 mm temporal or superotemporal corneal tunnel was created and anterior chamber was filled with viscoelastic substance. A CCC of 5mm size was made and nucleus was removed after hydrodissection. After thoroughly washing the cortical matter again viscoelastic was pushed in to the anterior chamber to inflate the capsular bag and a rigid PCIOL was placed. After implantation of PCIOL care was taken to remove all the viscoelastic material from sides as well as behind the PCIOL to prevent instability of the lens.

b) *Toric IOL procedure:* toric IOL power was calculated by using toric calculator provided by Care group also taking into account the SIA of 0.5D. Mendez ring (Endo webal) was used to mark the toric axis. Phacoemulsification was carried out via 2.8 mm clear corneal incision and customized toric with plate haptic (Care group) was implanted with due consideration of toric IOL axis marked with Mendez ring (Endo webal). A careful irrigation and aspiration was performed to remove the residual viscoelastic from anterior chamber and behind the tIOL. The final recheck of the tIOL axis was made by seeing the movement of micro bubbles created by hydro canula of 26G. Finally the AC was filled with BSS and procedure completed with intra cameral antibiotic and stromal hydration of wounds to seal it.

Follow-up

Patients were followed postoperatively at 1st post-op day, 2nd week and 10th week then monthly till the end of study.

The following outcomes were noted:

- Uncorrected and/or best corrected visual acuity.
- Intraocular pressure; if required (by Goldamnn Applanation Tonometer).
- Slit lamp examination.
- Kerotometry by Bausch & Lomb manual keratometer.
- Corneal topography by Tomey topographer.
- Fundus examination by direct or indirect ophthalmoscopy.

- Complications like hyphema, corneal edema, secondary glaucoma, anterior chamber reactions, TASS, iris atrophy, endophthalmitis & cystoid macular edema were noted.

Observation and Result

Patient characteristics are summarized as shown in table 1.

Table 1: Patient demographic and clinical information.

Parameter		Value
Mean age (y) ± SD		61.71±7.30
Mean age (y) ± SD		
	SICS with PCRI	63.04±5.92
	Toric IOL	58.40±9.15
No. of Patients		
	SICS with PCRI group	25
	Toric IOL implant group	10
Sex %		
	Male	20 (57.14%)
	Female	15 (42.86%)
Side(%)		
	Right eye	20 (57.14%)
	Left eye	15 (42.86%)

Preoperative difference in keratometry was in the range of 2.00–2.99 in 16 cases (45.7%) followed by 10 cases (28.6%) had ≥3.00 and least in the range of 1.00–1.99 i.e. in 9 cases (25.7%).

Table 2: Preoperative difference in Keratometry (ΔK).

ΔK	PCRI (%)	Toric (%)	Total (%)
1.00–1.99	9 (36)	0	9 (25.7)
2.00–2.99	13 (52)	3 (30)	16 (45.7)
≥3.00	3 (12)	7 (70)	10(28.6)

So, it is evident from above bar chart that most of the patients of PCRI group had keratometry difference in the range of 2.00–2.99D i.e. 13 cases (52%) followed by 9 (36%) patients had ΔK in the range of 1.00–1.99D and least number of cases i.e. 3 cases with keratometry difference of ≥3.00D. In Toric IOL group majority of the cases had keratometry difference of ≥3.00D i.e. 7 cases (70%) followed by 3 patients (30%) in the range of 2.00–2.99D and none of the patients had <2.00D keratometry difference.

In our study mainly two types of astigmatism i.e. WTR (with the rule) & ATR (against the rule) were considered and majority of the cases taken were of ATR types. Out of total 35 eyes 28 eyes (80%) had ATR astigmatism whereas only 7 eyes (20%) had WTR astigmatism which was comparable in both thje groups.

In our study majority of the patients i.e. 25 patients (71.4%) had preoperative BCVA (Best corrected visual acuity) in the range of HM–6/36.

Table 3: Best corrected visual acuity (BCVA) before surgical procedures.

Best Corrected Visual Acuity (BCVA)	PCRI Patients (N=25)	Toric IOL Patients (N=10)	Total Patients (N=35)
HM	5 (20%)	1 (10%)	6 (17%)
1/60 – 5/60	4 (16%)	2 (20%)	6 (17%)
6/60	3 (12%)	1 (10%)	4 (12%)
6/36	6 (24%)	3 (30%)	9 (26%)
6/24	2 (8%)	3 (30%)	5 (14%)
6/18	3 (12%)	0	3 (8%)
6/12	2 (8%)	0	2 (6%)

Preoperative best corrected visual acuity was examined. Majority of the patients in Group A (PCRI) had best corrected visual acuity in the range of HM- 6/36 which is about 70% of total PCRI Group patients. In Toric IOL Group majority of patients had best corrected visual acuity in range of 6/36 – 6/24 (60%).

Table 4: Comparison of best corrected visual acuity at 10th week after surgical procedure.

Best Corrected Visual Acuity (BCVA)	PCRI Patients N=25 N (%)	Toric IOL Patients N =10 N (%)
< 1/60	0%	0%
1/60–5/60	0%	0%
6/60–6/24	2 (8%)	0%
6/18–6/12	8 (32%)	1 (10%)
6/9–6/6	15 (60%)	9 (90%)

The best corrected visual acuity at 10th week in the range of 6/9–6/6 of both group A (PCRI) and group B (Toric IOL) were 60% and 90% respectively. Toric IOL group there was more improvement in BCVA at 10th week.

Discussion

As a result of theoretical and technological developments in cataract surgery, surgeons can now replace the cataractous lens with an artificial lens in a minimally invasive procedure, increasing the significance of the refractive outcomes. To optimize visual outcomes and minimize spectacle dependence, both the spherical and the astigmatism components of the refractive error must be addressed. The prevalence of astigmatism increases with age. It is estimated that approximately 50% of the population older than 60 years has more

than 1.00 diopter (D) of astigmatism and that up to 22% of cataract surgery candidates have pre-existing astigmatism exceeding 1.50 D. Although not firmly established, the level of cylindrical defect that can be considered clinically significant is approximately 0.50 to 1.00 D. Treatment options to address preoperative regular astigmatism include positioning or enlarging the main incision, performing astigmatic keratotomy, creating opposite clear corneal incisions, using laser ablative procedures, and implanting a toric intraocular lens (IOL). In eyes with low to moderate astigmatism, creating peripheral corneal relaxing incisions (PCRIs), also known as limbal relaxing incisions (LRIs), is one of the most widespread techniques. Although less powerful than keratotomies that are more central, the advantages of these incisions include a lower risk for induced irregular astigmatism, a consistent 1:1 coupling ratio, ease of execution, and fewer complications. Moreover, studies of recently introduced toric IOLs show them to be a promising option with excellent outcomes. This study compared the effectiveness, predictability, and safety of both techniques in the treatment of preoperative astigmatism during cataract surgery. Outcomes included visual and refractive results and quality of life and need for spectacles. In our study we categorized the patients in to 3 groups on the basis of difference in keratometry (ΔK) i.e. 9 patients (25.7%) having keratometry difference in the range of 1.00–1.99D, 16 patients (45.7%) having keratometry difference of 2.00–2.99D and 10 patients (28.6%) having keratometry difference ≥3.00D. The mean of ΔK in whole study group was 2.42±0.81D and the mean of ΔK in both groups PCRI and toric group was respectively 2.08±0.56D and 3.28±0.75D. Similarly study done by Bachernegg A. et al[9] the pre-operative ΔK was 3.29±0.84D which is almost similar to our study. All other studies done by different authors like Mingo Botin et al[10] and Javier Mendicute et al[11] taken pre-operative astigmatism (ΔK) <3.00D so they encountered mean ΔK less than our study. In study done by Mingo Botin et al[10] mean ΔK 1.91± 0.48D in PCRI group and 1.73±0.38D which is significantly less than our observation. In study done by Javier Mendicute et al[11] mean ΔK in PCRI group was 1.77±0.12 and mean ΔK in Toric IOL group was 1.90±48. In our study pre-operative BCVA(Best Corrected Visual Acuity) was done by Snellen's chart and 6 patients (17%) had HM vision, 6 patients (17%) in the range of 1/60–5/60, 4 patients (12%) had 6/60 as BCVA, 9 patients (26%) had BCVA of 6/36, 5 patients (14%) had BCVA 6/24, 3 patients (8%) had 6/18 and 2 patients (6%) had 6/12 as BCVA. None of the patients had pre-op BCVA better than 6/12. For better comparison of visual acuity with different authors we converted Snellen's Visual Acuity into LogMAR scale. So, in our study, mean LogMAR best corrected visual acuity pre-operatively was 1.0378±0.47. In both the groups pre-op LogMAR best corrected visual acuity was 1.0053±0.51 and 1.1192±0.38 in PCRI group and Toric IOL implant group respectively. In PCRI group there were total 25 patients in our study in which 5 patients had WTR astigmatism and 20 patients had ATR astigmatism. In ATR astigmatism we performed SICS with temporal incision along with 1 PCRI whereas in 5 patients who had WTR astigmatism were underwent SICS with superotemporal incision along with 1 PCRI because all the patients of the WTR astigmatism was operated for right eye (RE) so superotemporal incision was given. In Toric IOL implant group all 10 patients underwent phacoemulsification surgery via temporal route and plate haptic Toric IOL (Ultima smart toric by Care group) was placed according to the axis provided by toric calculator. There was significant improvement in the best corrected visual acuity at 10th week postoperatively. The best corrected visual acuity at 10th week was mostly in the range of 6/9–6/6 in both the groups. BCVA in Group A (PCRI) and group B (Toric IOL) was 60% and 90% respectively. In Toric IOL group there was more improvement in BCVA at 10th week. In LogMAR the BCVA of all 35 patients 10th week post-operatively was 0.502±0.36. LogMAR value of BCVA for both the groups i.e. PCRI group and Toric IOL group was 0.429±0.33 and 0.183±0.14 respectively. In Toric IOL implant group there were total 10 patients in this study and 9 out of 10 had BCVA in the range of 6/9–6/6 and none of them received cylindrical glasses more than 0.50 D, only one patient received cylindrical glass of 1.50 D in whom intra-operative complication in the form of PCR was occurred and Iris claw lens was implanted. In PCRI group majority of patients achieved good vision without cylindrical glass prescription but if cylindrical glass was required was not more than 1.00D in any case. Out of the 35 cataract operated patients with regular corneal astigmatism, all had a history of spectacle usage preoperatively. 23 (65.71%) patients did not require spectacles post operatively whereas 12 (34.29%) still required to be prescribed glasses after final follow up at 10th week.

Conclusion

In our study we found that Toric IOL implant was superior than peripheral corneal relaxing incision because later method had limited application in following situations

1. Peripheral corneal relaxing incision cannot be used for moderate to high astigmatism.
2. Results obtained by peripheral corneal relaxing incision are not predictable and more or less depends on surgical skills of the surgeon.
3. Spectacle dependence of PCRI group was more than Toric IOL implant group in our study as well as study by different authors.
4. Although cost wise PCRI is better option over Toric IOL implant for correcting pre-operative astigmatism.
5. But toric IOLs had better predictability and precision over PCRI for correcting pre-operative astigmatism.
6. In cases with pre existing corneal astigmatism toric IOLs are the best possible intervention and continues to remain the gold standard.

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