

Ocular Surface Tear Film Abnormalities Following Small Incision Cataract Surgery

Anupama Raju Taklikar¹, Megha R Triwadi²,
Prasanth R Kamatham³

Abstract

Aim: To know the influence of small incision cataract surgery on tear film by measuring dryness symptoms using ocular surface disease index (OSDI) score and quantify changes in tear film using tear meniscus height, schirmers test 1, TBUT, Fluorescein staining, impression cytology.

Material and method: A prospective descriptive study was conducted among 180 patients undergoing small incision cataract surgery in department of ophthalmology, NMCH Raichur.

Results: Out of 180 patients, the mean age group was 56.87±9.50 years. Mean value of pre-operative vs post-operative 1st, 3rd, 6th week for OSDI was 11.274, 21.932, 18.880, 15.376 respectively. Schirmers 1 test showed mean 21.755, 12.322, 15.738, 17.016. TBUT values were 12.689, 7.922, 8.400, 9.961 respectively. Tear meniscus height mean scores were 0.301, 0.215, 0.161, 0.212 respectively. Mean value of impression cytology showed 732.05±232.46 and 356.36±107.16 cells/mm². Oxford scheme grading showed grade 1 in pre-operative period and grade 1, 2, 1 in post-operative follow-up for 1st, 3rd, 6th week respectively.

Conclusion: A significant number of patients with no dryness symptoms before cataract surgery developed tear film abnormalities in the immediate post-operative period. Studies with longer time periods are recommended to assess time taken for tear film to recover to pre-operative state. In addition, these patients also needed to be started on lubricating drops intensively prior to surgery for patient comfort post-operatively.

Keywords: Small incision cataract surgery; Tear film; OSDI score; Schirmers test; TBUT.

How to cite this article:

Anupama Raju Taklikar, Megha Ramesh Triwadi, Prashanth .R. Kamatham/Ocular Surface Tear Film Abnormalities Following Small Incision Cataract Surgery; 2021; 7(2):11-15.

Introduction

Cataract is the leading cause of blindness in the world at the same time cataract surgery is the most successful surgery in the field of ophthalmology. However, after cataract surgery, many patients complain of foreign body sensation, irritation, redness, blurring of vision which is considered as an unwanted effect of surgery.¹

An ocular surface tear film abnormality is frequently encountered ocular problem in tropical climate which

mainly occurs when there is inadequate tear volume or function²

A dry eye produces discomfort and reduces vision when the tear film becomes chronically unstable and repeatedly breaks up into dry eye spots between the blink, exposing the corneal and epithelial pre-film to evaporate. Affected patients may experience red and watery eyes along with constant foreign body sensation. Some studies have reported aggravation in dry eye symptoms and signs after cataract surgery.⁴

Dry eye can develop or deteriorate after cataract surgery if not treated on time. Misuse of eye drops is one of the major pathognomonic factors. Indiscriminate use of topical antibiotics causes histological and ultrastructural changes in the conjunctiva leading to decreased TBUT time and a dry eye state.⁵ Small incision and other limbal

Authors Affiliation

¹Professor and HOD, ²Junior Resident, ³Senior Resident, Department of Ophthalmology, Navodaya Medical College, Raichur 584103, Karnataka, India.

Corresponding Affiliation

Megha Ramesh Triwadi, Junior Resident, Department of Ophthalmology, Navodaya Medical College, Raichur 584103, Karnataka, India.

Email: santhuyadav.md@gmail.com

relaxing incision causes local damage by dissection of circumcorneal network of nerve fibers which results in corneal hyposensitivity which results in reduced reflex secretion and epithelial wound healing, this along with prolonged exposure of intraoperative microscopic light can worsen the symptom.

Method

A study was conducted on 180 patients who were to undergo cataract surgery in Navodaya Medical College, Raichur. The study included cases who came to ophthalmology outpatient department of ophthalmology with complaints of diminished vision due to cataract from January 2017 to June 2018. Patients who have signed on written and informed consent in their understandable language, patient receiving same brand of ofloxacin and dexamethasone eye drop after surgery were included in study. Patients were informed about the purpose of study they are undergoing. Patients with ocular disease like dry eye, complicated cataract, glaucoma, uveitis disorder of eyelid or nasolacrimal duct pathway, pterygium were excluded. Patients with previous ocular surgery, smoking history, any intraoperative complication during surgery, insertion of anterior chamber IOL were excluded from the study. All the patients who walked in OPD and were advised cataract surgery underwent detailed ocular examination which included Visual acuity with pinhole and refractive error correction using Snellen's chart, Slit lamp examination and applanation tonometry, Lacrimal syringing, Fundus evaluation, Keratometry, scan biometry with IOL calculation, General physical and systemic examination and Investigation like RBS, blood routine, ECG. Special test for dry eye included OSDI Score, TBUT, Schirmer's 1 test without anesthesia including Oxford scheme, tear meniscus height, impression cytology, corneal sensation were evaluated.

Pre-operative preparation of eyes included dilation of pupil with topical 0.8% phenylephrine plus 5% eye drop every 10 min for 2 hours before surgery. Peribulbar block was given with 0.5% bupivacaine and 2% lignocaine. Manual small incision cataract surgery was performed with superior self-sealing scleral corneal tunnel incision of 6.5 mm size. A side port of size 1 mm was performed at 3 or 9 o'clock. All patients underwent PCIOL implantation the range of each surgery was 10-20 minutes. After surgery all patients used topical moxifloxacin 0.5% and dexamethasone 0.1% 6 times a day tapering over period of 6 weeks.

Presence of tear film abnormalities on day before surgery was assessed using OSDI questionnaire. A 12-item questionnaire was used worldwide to assess symptoms of dry eye. We modified the questionnaire 4 and 5 which assess the presence of blurred and poor vision.

Total OSDI score was calculated using the formula:

$$\text{OSDI Score} = \frac{\text{Sum of all answered questions}}{\text{Total no. of answered questions}}$$

OSDI ranges from 0 to 100. Score above 25 indicated dry eye symptoms. After completion of questionnaire tear film stability and functional test were performed which included:

TBUT:

- After staining the ocular surface with fluorescein sodium 1% impregnate strips moistened with saline.
- Time between last blink and appearance of first dry spot was calculated.
- Three TBUT scores were analyzed to determine presence of dry eye.
- An average score of 10 sec was considered as normal. TBUT shorter than 10 sec was considered as dry eye.

Conjunctival and corneal staining:

- Conjunctival and corneal staining was graded using Oxford scheme.
- 0 to 1 grade indicated normal eye.
- 2 to 5 grade indicated dry eye.

Tear meniscus height:

- The tear lake that accumulates at junction of bulbar conjunctiva and lower lid margin was measured using measuring scale in the reticule or an adjustable slit beam height.
- Less than 0.4 mm was considered as dry eye.

Conjunctival cytology:

- It was done pre-operatively and post-operatively on 6th week by transfer method after anesthetizing cornea with 0.5% proparacaine.
- A 0.22 micron filter paper of 13mm diameter was grasped in blunt forceps and placed over bulbar conjunctiva.
- It was obtained from non-exposed conjunctiva to eliminate environment-related factors on ocular surface.
- Filter paper was removed in peeling fashion after 4-10 sec and was transferred to lab for

fixation (ethyl alcohol, formaldehyde, glacial acetic acid) in 20:1:1 ratio and was stained.

- Due to relative ease of handling the filterpaper was first placed on glass slide with albumin paste then transferred to slide. However loss of adhered material to filter paper was disadvantage.
- Filter paper was then removed from slide and slide was stained with PAS (Periodic Acid Schiff) while counterstained with H & E (Hematoxylin and eosin).
- Localization of cell was with 100x, low power 10x after localizing analysis for goblet cell per high power field HPF was marked and counted. Minimum 10 HPF were examined for goblet and epithelial cell.
- The goblet cell density was estimated by formula.
- No. of goblet cell per HPF ÷ Sampling area in mm²
- Grading was carried according to Nelson Criteria. Where in grade 0 to 1 were regarded as normal, grade 2 and were considered as dry eye.

Incidence of dry eye was calculated from OSDI on postoperative day 7. The severity pattern of dry eye was assessed from OSDI, TBUT, tear meniscus height, Schirmer's 1 test and Oxford scheme.

Result

This was a prospective descriptive study of 180 patients who underwent small incision cataract surgery at Navodaya Medical College from January 2017 to June 2018. Majority of patients in this study were between age group 51-60 consisting 74 patients. There were 53 patients aged between 61-70 and 4 patients above 70 years. Mean age of patient in our study was 56.87±9.50 (SD) years.

Out of 180 patients under study group 103 were female (57%) and 77 were male (43%).

Table 1: OSDI distribution.

OSDI	N	Mean	Std. Deviation
Pre operative	180	11.274	3.877
Post operative 1 week	180	21.932	9.319
Post operative 3 week	180	18.880	6.849
Post operative 6 week	180	15.376	5.282

OSDI questionnaires which weights symptoms of ocular discomfort showed mean score of 11.274 in pre operative stage and mean score of 21.932, 18.880, 15.376 on post operative 1st, 3rd and 6th week. Significant change in standard deviation was seen

which improved over the weeks postoperatively.

Table 2: Schirmer's test distribution.

Schirmer's Test	N	Mean	Std. Deviation
Pre-operative	180	21.7556	4.41382
Post operative 1 week	180	12.3222	4.02458
Post operative 3 week	180	15.7389	3.83655
Post operative 6 week	180	17.0167	3.00739

Schirmer's test was conducted with Whatman 41 filter paper pre operatively as well as post operatively. The mean score in pre operative period was 21.7556 while post operatively in 1st, 3rd and 6th week was 12.3222, 15.7389, 17.0167 respectively.

Table 3: TBUT distribution.

Tbut	N	Mean	Std. Deviation
Pre-operative	180	12.689	1.709
Post-operative 1 week	180	7.922	2.425
Post-operative 3 week	180	8.400	1.814
Post-operative 6 week	180	9.961	1.428

Tearfilm breakup time assessment pre operatively showed mean score of 12.689 and significant reduction was seen on post operative 1st, 3rd, 6th week as 7.922, 8.400, 9.961 respectively.

Table 4: Oxford scheme score distribution.

Oxford scheme	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Pre operative	47.2 %	52.78 %	0	0	0
Post operative 1 week	0	33.89%	40%	23.9%	2.2%
Post operative 3 week	0	41.67 %	47.8%	10.6%	0
Post operative 6 week	27.8 %	50.00%	21%	1.1%	0

Oxford scheme grading of most patients pre operatively was grade 1 and post operatively week 1, 3 and 6 were grade 1, grade 2 and grade 1 respectively.

Table 5: Tear meniscus distribution.

Tear Meniscus	N	Mean	Std. Deviation
Pre operative	180	0.301	0.027
Post operative 1 week	180	0.215	0.050
Post operative 3 week	180	0.161	0.040
Post operative 6 week	180	0.212	0.013

Tear meniscus height showed mean 0.3 mm height pre operatively while 0.215, 0.161, 0.212 on 1st, 3rd, 6th week respectively post operatively.

Table 6: Impression cytology distribution.

Impression cytology	N	Mean	Deviation	Error
		std.	std.	mean
Pre operative	180	732.056	232.465	17.33
Post operative 6 week	180	356.389	107.161	7.99

Impression cytology showed significant variation in pre operative and post operative score varying from 732.056 to 356.389 respectively.

Discussion

This was a prospective descriptive study of 180 patient who underwent small incision cataract surgery at Navodaya Medical College, Raichur from January 2017 to June 2018. Majority of patient in this study were between age group 51-60 consisting 74 patients. There were 53 patient aged between 61-70 and 4 patient above 70 years. Mean age of patient in our study was 56.87 ± 9.50 (SD) years. In our study out of 180 patient, 103 patients were female and 77 were male similar result were seen in Framingham eye study also senile lens changes were more common in women. In our study OSDI score and four clinical test for tearfilm abnormalities were available from 180 patients. Our study showed significant abnormalities in oxford scheme and TBUT in immediate post operative period compared shirmers test. This is because oxford and TBUT evaluates quality of tearfilm and shirmers evaluates quantity of tearfilm. Since SICS is an ocular surface damaging procedure it produces damage to conjunctival goblet cell resulting in mucin deficiency and thus deteriorates quality of tear film. Sitompul R et al in his study found the group of patient undergoing SICS had poor tearfilm quality as compared to phacoemulsification. He described that initial procedure in SICS like conjunctival incision, cauterization of episcleral vessels damages conjunctival goblet cells resulting decreased mucin production.

On postoperative day 7 the mean scores of OSDI questionnaire (Preoperatively vs Postoperatively) was 11.27 ± 3.87 vs 21.93 ± 9.31 . Similarly comparison in pre operative and post operative values showed significant difference. TBUT showed 12.688 ± 1.708 vs 7.922 ± 2.425 seconds, oxford scheme showed grade 1 vs grade 2 and schirmers 1 test showed 21.755 vs 12.322 mm. Tear meniscus height showed 0.3007 ± 0.026 vs 0.2149 ± 0.049 .

Our results were compared sitompul R 8 et al in their study it was found that OSDI comparison results were 28.37 vs 29.01 , TBUT was 16.11 vs 10.59 sec and schirmers test was 14.07 vs 17.13 mm. Cho Y K et al 6 in his study to investigate dry eye changes following cataract surgery found that in the group with no dry eye preoperatively, all clinical tests showed significant worsening of dry eye immediately following surgery this findings are similar to our study. The deteriorating dry eye parameter were attributed to:

1. Use of topical steroid which causes toxicity to cornea and conjunctiva. The preservatives acts like detergents that causes breakdown of lipid layer. Supporting evidence was provided by Pisella 9 and colleagues as they compared prevalence of dry eye on glaucoma patient using preservative free and preservative added anti glaucoma drugs.
2. Corneal incision causes certain corneal irregularities that produce tear film disruption. Subbasal nerve plexus encounters cornea mainly at nasal and basal quadrant and then divide into central cornea hence corneal incision on temporal side cuts basal nerves and extension of incision reduces corneal sensitivity on and around area of incision.

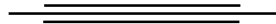
The reduced frequency of steroid antibiotic drops which was started post operatively and usage of preservative free tear substitute drops showed improvement in TBUT and reduced conjunctival epithelial expression of inflammatory markers one month postoperatively thus reducing signs and symptom post operatively similar results are proved by Sanchez and associates⁷¹ the suggested usage of hydroxypropyl (HP) – a preservative free artificial tear preparation to be used on regular basis for post operative patients.

Conclusion

In our study mean age of patient undergoing small incision cataract surgery was 58.86 year. 57 % patient were female and 43% patient were males. Cataract being most gratifying surgery in field of ophthalmology however patients were found to have deterioration in tear film. Our study showed significant deterioration in tear film quality and quantity in immediate post operative period and showed gradual improvement over 6 weeks. Hence we conclude from our study that significant number of patients with no dry eye disease before cataract surgery developed tear film abnormality in immediate post – operative period and needed to be started on preservative free eye drops pre operatively for better visual outcome and patient satisfaction. Although we noticed improvement in OSDI score and clinical test for tear film in the 6 week followup period, studies with longer time period are recommended to assess the time taken for tear film to recover to its pre operative status.

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