Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical and Experimental Ophthalmology

Journal homepage: www.ijceo.org

Original Research Article

Effect of manual small incision cataract surgery on pre-corneal tear film at a tertiary care centre

Kruthika S[1,*], **Usha B R**[1]

[1]*Dept. of Ophthalmology, Sri Devraj Urs Medical College, Kolar, Karnataka, India*

ARTICLE INFO

Article history:
Received 27-01-2023
Accepted 01-04-2023
Available online 30-06-2023

Keywords:
Pandemic
COVID- 19
Lockdown
Unlock
Anesthesia management
Emergency trauma surgery

ABSTRACT

Background: A common adverse effect of cataract surgery is dry eye disease (DED), which lowers postoperative patient satisfaction and results in substandard visual acuity. Tear film is disrupted during cataract surgery which leads to dry eye disease. Very few studies are available for the assessment of dry eye following manual small incision cataract surgery (MSICS) among the South Indian population. Hence, this study was conducted to determine the prevalence of dry eye and to evaluate tear film following manual small incision cataract surgery.

Materials and Methods: A prospective study was carried out in the Department of Ophthalmology at a tertiary care hospital for the assessment of dry eye following MSICS using dry eye indices like tear meniscus height, tear film break up time, Schirmer's Test 1 and Rose Bengal staining. The patients were assessed preoperatively and at one week, one month and three months postoperatively.

Results: In the first week following manual small incision cataract surgery, 21 eyes (33.3%), 26 eyes (41.3%), and 2 eyes (3.2%) experienced mild, moderate, and severe dry eyes, respectively. One month after MSICS surgery, 22 eyes (34.9%), 19 eyes (30.2%) and 1 eye (1.6%) had mild, moderate and severe dry eye respectively. The mean values of dry eye indices were normal preoperatively and significantly reduced at the one-week and one-month postoperative review.

Conclusion: The dry eye illness began to manifest immediately following cataract surgery and peaked on day seven. Over time, symptoms of dry eye was seen to decrease. Despite satisfactory visual recovery, dry eye illness is a typical post-cataract surgery complaint that negatively impacts patient satisfaction and must be assessed and treated promptly.

1. Introduction

Globally 94 million people were addressed with vision loss due to cataract.[1] A cataract is the impairment of lens transparency brought on by the lens opacification.[2] In 2020, cataract was the main cause of blindness in people over 50 years of age.[3]

With significant improvement in activities of daily living, lower mortality, and immediate improvement in visual acuity, cataract surgery is one of the most effective surgical interventions.

A common adverse effect of cataract surgery is dry eye disease (DED), which lowers postoperative patient satisfaction and results in substandard visual acuity.[4] One of the key elements impacting elderly individuals' quality of life (QOL) is dry eye.[5]

Even though cataract surgery is an intraocular procedure, microscopic ocular surface damage is indeed caused, which may exacerbate any ocular surface diseases already present or result in dry eyes.[6] The procedure of performing cataract surgery causes ocular inflammation, which may have a negative impact on patients' tear-film integrity and

* *Corresponding author*.
E-mail address: eversweetkruthika@gmail.com (Kruthika S).

https://doi.org/10.18231/j.ijceo.2023.029

formation.[7] The prolonged use of antibiotic-steroid eye drops, decreased tear film breakup time due to surface irregularity at the incision site, decreased mucin production from the conjunctiva as a result of incision placement, decreased corneal sensation as a result of surgical incision which disrupts the cornea-lacrimal gland loop resulting in reduced tear secretion, poor tear film production, and poor stabilisation due to surgical inflammation are factors that contribute to the development of dry eye after cataract surgeries.[8] Tear film was disrupted during cataract surgery which leads to dry eye disease. Very few studies are available for the assessment of dry eye following manual small incision cataract surgery among South Indian population. Hence, this study was an opportunity to determine the prevalence of dry eye and to evaluate tear film following Manual Small Incision Cataract Surgery.

2. Materials and Methods

This prospective study included 63 patients with cataract posted for manual small incision surgery in a tertiary care institute in Karnataka in the Department of Ophthalmology between January 2021 and June 2022, who underwent detailed cataract and dry eye evaluation after obtaining the approval from Institutional Ethical Committee, which were included in this preoperative study.

Data was collected from the outpatient department of Ophthalmology among patients with senile cataracts. All patients underwent uneventful manual SICS with either superior or temporal sclerocorneal incision.

Patients above 50 years were included. Patients with surgical complications, pre-existing dry eyes, Sjogren's syndrome, rheumatoid arthritis and other autoimmune disorders and those having patients with pre-existing ocular diseases like glaucoma, uveitis, disorders of the lid or the nasolacrimal pathway, ocular allergies, pterygium and previous ocular surgeries were not included in the study. Patients lost follow up were excluded.

Clinical examination included comprehensive anterior segment evaluation done by slit lamp biomicroscopy, to rule out any pre-existing ocular surface disease. TMH, TBUT, ST1, RB staining was done in all patients.

The patients were started on topical antibiotics one day before surgery. On the day of surgery, pupils were dilated using 0.8 mg tropicamide and 10% phenylephrine hydrochloride drops 90 minutes before cataract surgery.

A manual small incision cataract surgery with either superior or temporal sclerocorneal tunnel was performed under peribulbar block. The incision was 6 to 6.5 mm in length and 1.5 to 2 mm from the limbus. A rigid PMMA intraocular lens was implanted in all patients. A standard post operative regime was followed in all the patients. All patients received topical steroid antibiotic combination in tapering doses for 8 weeks. Post operative evaluation was done at 1 week, 1 month and 3 months. At each visit TMH, TBUT, ST1 and RB staining was done.

Tear meniscus height was recorded as normal or low (under narrow beam of slit lamp). Precorneal tear film was observed for presence of debris (mucous/oil droplets /debris)

The TBUT measures the interval between the last complete blink and the first randomly placed dry spot over cornea after application of 2% fluorescein dye. The readings were recorded at the slit lamp using cobalt blue filter. Three TBUT readings were taken and average was calculated. TBUT less than 10 seconds was considered as dry eye.

Schrimer's test(ST1) was done by using 5×35 mm sterile strips of Whatman No.41 filter paper. ST1 was evaluated by inserting a Schirmer paper strip in the lower fornix at the junction of middle and lateral third of the lower fornix for 5 minutes. Wetting of 10 mm or less is considered as dry eye.

2.1. Rose Bengal stain (RB)

Rose Bengal stain is a measure of assessing ocular surface damage. A sterile, commercially available Rose Bengal strip moistened with 4% xylocaine was applied to the inferior cul de sac. After 15 seconds, the eye was examined for staining of cornea and conjunctiva under red free light or bright light under the slit lamp. Van Bijsterveld scoring system was used to grade the staining of cornea and conjunctiva, based on a scale of 0-3 in 3 areas: nasal conjunctiva, temporal conjunctiva, and cornea. An additive score of 4 or more in the eye was considered as positive test.

Presence of dry eye and their categorization was represented as categorical data. Mild, moderate, and severe categories of dry eye were used. Mild dry eye were ST1 less than 10 mm in 5 min, TBUT less than 10 s, and less than 1 quadrant of Rose Bengal staining on the cornea were considered to have mild dry eye. The definition of moderate dry eye includes ST1 of 5–10 mm in 5 min and TBUT of 5–10 s with punctate staining of more than one corneal epithelial quadrant by Rose Bengal. The conjunctival epithelium was described as diffuse punctate or confluent staining with ST1 less than 5 mm in 5 minutes and TBUT less than 5 seconds in cases of severe dry eye. The corneal epithelium was described as diffuse punctate or confluent staining with Rose Bengal, usually with filaments.

In Microsoft excel, data was recorded using 2019 version and was analysed using "SPSS version 21 software. Categorical data and Continuous data were represented in the form of Frequencies (Mean ± Standard deviation) and proportions respectively. The paired values (pre-op and post-op) were analyzed for association using paired T-test for continuous variables. Test of association was tested by chi-square test (categorical variables) and independent T-test (continuous variables).P value <0.05 was considered statistically significant.

3. Results

This study was conducted among 63 patients with cataract posted for manual small incision surgery to assess precorneal tear film. The mean age of participants was 64.02 ± 9.361 ranging from 51 – 85 years. Age group follows normal distribution. 54% of men and 46% of women participated in this study. The normal tear meniscus height ranged from 0.2 – 0.5. The mean TMH values varies from 0.215±0.143, 0.294±0.144 and 0.363±0.153 respectively during one week, one month and three months after post operative day. The mean Schirmer's test values varied from 11.35±4.820, 13.52±6.701 and 26.78±4.531 respectively during one week, one month and three months post operatively. The mean tear film break up time values varied from 8.25±1.606, 8.33±2.155 and 21.22±3.594 respectively during one week, one month and three months after post-operative day.

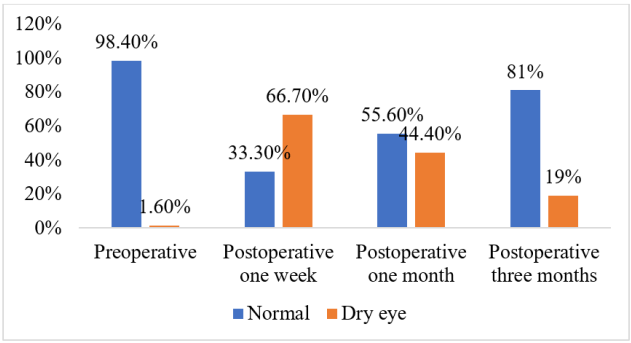

Fig. 1: Prevalence of dry eye based on TMH

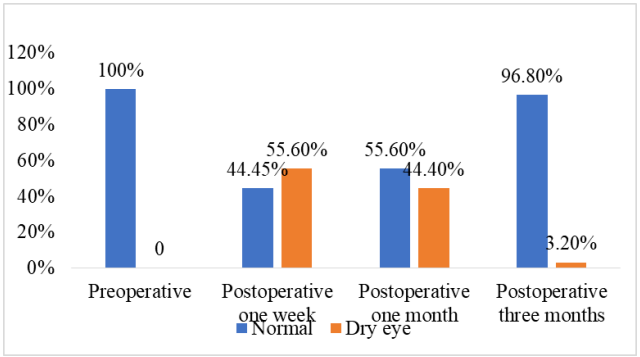

Fig. 2: Prevalence of dry eye based on Schirmer's test

3.1. Comparison of pre-operative and post-operative findings

3.1.1. Tear meniscus height

The mean value tear meniscus height was reduced on one week after post operative day (0.215±0.143), and one month after post operative day (0.294 ±0.144) and this value was significant statistically. It was also reduced at three months after surgery (0.363 ±0.153) but the value was not statistically significant.

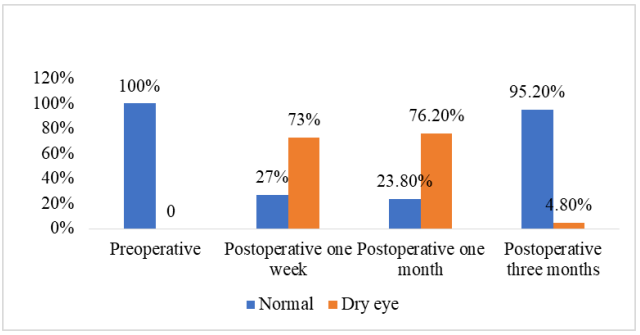

Fig. 3: Prevalence of dry eye(less than 10 seconds) based on tear film breakup time

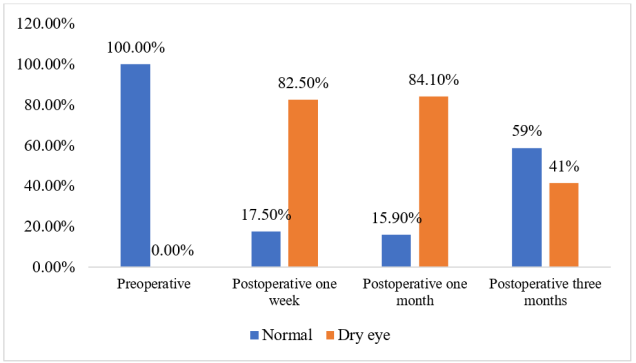

Fig. 4: Prevalence of dry eye based on Rose Bengal stain

3.1.2. Schirmer test

The mean value of Schirmer's test results were reduced at one week post operative review (11.35 ±4.820), one month after post operative day (13.52±6.701) and this value was significant. It was also reduced three months after post operative day (26.78 ±4.531) and the value was significant.

3.1.3. Tear film break up time

The mean value of tear film break up time was reduced at one week post operatively day (8.25±1.606), and one month post operatively day (8.33±2.155) this value was significant. It was also reduced at three month review (21.22±3.594) and the value was significant.

3.1.4. Rose Bengal test

The mean score of Rose Bengal test had a statistically significant difference at one week and one month of the postoperative period. The scores were significantly higher compared with the preoperative period.

Dry eye was defined as patients who had two positive clinical tests (TBUT = 10 seconds, ST1 score = 10 mm, RB

statin score of > four). Patients with ST1 less than 10 mm in 5 minutes, TBUT less than 10 seconds, and less than one quadrant of staining of the cornea by RB are considered to have mild dry eyes. A ST1 of 5 to 10 mm in 5 minutes, a TBUT of 5 to 10 seconds, and punctate staining of more than one corneal epithelial quadrant by RB are considered signs of moderate dry eye. Diffuse punctate or confluent staining (with RB) of the corneal epithelium, frequently with filaments, with ST1 less than 5 mm in 5 minutes and TBUT less than 5 seconds is considered to be severe dry eye.

In the first week following MSICS, 21 eyes (33.3%), 26 eyes (41.3%), and 2 eyes (3.2%) experienced mild, moderate, and severe dry eyes, respectively.

A month after MSICS surgery, 22 eyes (34.9%), 19 eyes (30.2%) and 1 eye (1.6%) had mild, moderate and severe dry eye respectively.

4. Discussion

Dry eye disease or dry inflammation of the cornea and conjunctiva is referred to by the Latin phrase "keratoconjunctivitis sicca." Swedish ophthalmologist Henrik SC Sjogren originally coined the phrase, which Andrew De Roetth revived as "dry eye" in 1950.[9] Dry eye is a tear film condition brought on by inadequate production or excessive evaporation of tears, which damages the interpalpebral ocular surface and is linked to sensations of ocular discomfort. The recent definition by Dry Eye Workshop II (DEWS II) of the Tear Film and Ocular Surface Society (TFOS) defined that Dry eye is a multifactorial condition of the tears and ocular surface that causes symptoms of pain, blurred vision, and tear film instability as well as the risk for ocular surface injury.[10] Along with it, the ocular surface becomes inflamed and the tear film's osmolarity increases.[11] A dry eye may occur as a complication of surgical treatments, where the sensory nerves found on the surface of the eye may unavoidably sustain injury. The corneal sensation is decreased in the absence of accurate sensory detection, which reduces basal and reflex tearing as well as blinking frequency. Additionally, sensory denervation will prevent the lacrimal gland from producing tears, which will result in less tear secretion. The lipid layer of the tear film might become thinner after cataract surgery and become unstable, leading to dry eyes. Corneal nerve injury sustained after surgery might be the reason for decreased tear production. The human body's largest concentration of sensory nerve endings is found in the cornea. The loss of cytoskeletal structures, increased permeability, lower metabolic activity, and impaired epithelial wound healing are all possible side effects following the transection of these nerves. Clinically, we can see a decline in corneal sensitivity followed by a decline in tear production, which results in dry eyes with insufficient aqueous tears.[12,13] The mucinous portion of the tear film is secreted by goblet cells. Therefore, it follows that a decrease in mucin-producing cells could undermine the tear film's integrity and result in an evaporative dry eye. Goblet cells, which lubricate the eye, may be diminished by exposure to a narrow beam of microscope light used by ophthalmic surgeons.

The prevalence of dry eye varies across the studies. Patients who underwent MSICS experienced dry eye in one week, one month and three months of postoperative day.

Present study showed that 55.6%, 44.4%, 3.2% of patients had dry eye based on Schirmer's test1 (less than 10mm) during one week, one month and three months after post-operative period. Our study depicted that 66.7%, 44.4%, 19% of patients had low TMH based on (< 0.2) during one week, one month and three months after post-operative period. Our study described that 73%, 76.2%, 4.8% of patients had dry eye based on Tear film break up time (low TBUT < 10 sec) during one week, one month and three months after post-operative period.

66.7%, 44.4%, 19% of patients had dry eye based on Tear Meniscus height (< 0.2) during one week, one month and three months after post operative period. 55.6%, 44.4%, 3.2% of patients had dry eye based on Schirmer's test1 (less than 10mm) during one week, one month and three months after post operative period. 73%, 76.2%, 4.8% of patients had dry eye based on Tear film break up time (less than 10 seconds) during one week, one month and three months after post operative period. 82.5%, 84.1% and 41% of eyes had dry eyes in the postoperative period of one week, one month and three months respectively based on Rose Bengal staining.

The mean value tear meniscus height was reduced on one week after post operative day (0.215±0.143), and one month after post operative day (0.294 ±0.144) from pre operative value (0.4102 ±0.118) and this value was significant statistically. It was also reduced on three months after post-operative day (0.363 ±0.153) but the value was not statistically significant. The mean value of Schirmer's test results was reduced on one week after post-operative day (11.35 ±4.820), and one month after post-operative day (13.52±6.701) from pre operative value (28.06 ±2.094) and this value was significant. It was also reduced on three months after post-operative day (26.78 ±4.531) and the value was significant. The mean value of tear film break up time results was reduced on one week after post-operative day (8.25±1.606), and one month after post-operative day (8.33±2.155) from pre operative value (22.49 ±2.078) and this value was significant. It was also reduced on three months after post-operative day (21.22±3.594) and the value was significant. The mean score of Rose Bengal test had a statistically significant difference in one week, one month and three months of the postoperative period. The scores were significantly higher compared with the preoperative period.

Table 1:

Studies	One week	One month	Three months
Our study	21 eyes (33.3%), 26 eyes (41.3%), and 2 eyes (3.2%) experienced mild, moderate, and severe dry eyes	22 eyes (34.9%), 19 eyes (30.2%) and 1 eye (1.6%) had mild, moderate and severe dry eye	5 eyes (6.3%) had mild dry eye
Ishrat S et al [14]	27%, 11% and 4% of eyes had mild, moderate and severe dry eye	12% and 3% of eyes had mild and moderate dry eye	7.1% and 3.5% of eyes had mild and moderate dry eye
Garg P. et al. [15]	92.9% dry eye	26.8% dry eye	-
Venugopal K et al. [16]	-	Mild dry eye (53.32%), Moderate dry eye (26.6%), and severe dry (20%).	-

The dry eye was categorized into mild (less than 10 mm), moderate (5–9 mm) and severe (less than 5 mm) based on Schirmer's test. 7.9% and 4.8% of patients had mild dry eye during one week and one month of post-operative period. 55.6%, 44.4% and 3.2% of patients had moderate dry eye during one week one month and three months of postoperative period. The dry eye was categorized into mild (less than 10 seconds), moderate (5–9 seconds) and severe (less than 5 seconds) based on Tear film break-up time. 27% and 22.2% of patients had mild dry eye during one week and one month of post-operative period. 73%, 76.2% and 4.8% of patients had moderate dry eye during one week one month and three months of postoperative period. During one week after the postoperative period, 54% had mild dry eye, 12.7% had moderate dry eye and 15.9%) had severe dry eyes based on Rose Bengal staining. 57.1%, 15.9%, and 11.1% had mild, moderate and severe dry eye in a one-month follow-up post-operative period graded by Rose Bengal staining. 41.3% had mild dry eye even after three months of the postoperative follow-up period.

5. Conclusion

The mean values of dry eye indices were normal preoperatively and became lower during the follow-up postoperative period exclusively on day 7 compared to one month postoperatively. Preoperative evaluation should be carried out adequately using tests for tear film formation and stability as well as questionnaires about symptoms of dry eyes. Dry eye symptoms can appear immediately following cataract surgery, peak on day 7, and become better over time. However, in order to guarantee that the patients receive the right care, have good vision, and have a good quality of life, ophthalmologists must evaluate dry eye both before and after cataract surgery.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Vision impairment and blindness [Internet]. [cited 2022 Sep 28]. Available from: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment.
2. Liu YC, Wilkins M, Kim T, Malyugin B, Mehta JS. Cataracts. *Lancet*. 2017;390(10094):600–12.
3. Steinmetz JD, Bourne RRA, Briant PS, Flaxman SR, Taylor HRB, Jonas JB. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. *Lancet Glob Health*. 2021;9(2):144–60.
4. Miura M, Inomata T, Nojiri S, Sung J, Nagao M, Shimazaki J, et al. Clinical efficacy of diquafosol sodium 3% versus hyaluronic acid 0.1% in patients with dry eye disease after cataract surgery: a protocol for a single-centre, randomised controlled trial. *BMJ Open*. 2022;12(1):e052488.
5. Li XM, Hu L, Hu J, Wang W. Investigation of dry eye disease and analysis of the pathogenic factors in patients after cataract surgery. *Cornea*. 2007;26(9 Suppl 1):16–20.
6. Ubeid AMR, Ubeid AMR. The Unsatisfied Patient after Cataract Surgery Ocular Surface Disease as a Major Contributor! [cited 2022 Sep 28]. Available from: https://clinmedjournals.org/articles/ijocr/international-journal-of-ophthalmology-and-clinical-research-ijocr-5-095.php.
7. Calif UD, Valley S. Dry-Eye Syndrome after Cataract Surgery. Available from: https://www.reviewofophthalmology.com/article/dry-eye-syndrome-after-cataract-surgery.
8. Ishrat S, Nema N, Chandravanshi SCL. Incidence and pattern of dry eye after cataract surgery. *Saudi J Ophthalmol*. 2019;33(1):34–40.
9. Zeev MSB, Miller DD, Latkany R. Diagnosis of dry eye disease and emerging technologies. *Clin Ophthalmol*. 2014;8:581–90.
10. Maurya RP. Dry eye disease: An overview. *Indian J Clin Exp Ophthalmol*. 2018;4(4):433–4.
11. The definition and classification of dry eye disease: report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop (2007). *Ocul Surf*. 2007;5(2):75–92.
12. Sutu C, Fukuoka H, Afshari NA. Mechanisms and management of dry eye in cataract surgery patients. *Curr Opin Ophthalmol*. 2016;27(1):24–30.
13. Dorennavar L, Maurya RP, Singh VP, Singh MK, Sharma K, Sharma R. The role of Rebamipide ophthalmic suspension in management of dry eye disease. *Indian J Clin Exp Ophthalmol*. 2015;1(4):191–6.

14. Fodor E, Hagyó K, Resch M, Somodi D, Németh J. Comparison of Tearscope-plus versus slit lamp measurements of inferior tear meniscus height in normal individuals. *Eur J Ophthalmol*. 2010;20(5):819–24.
15. Lamberts DW, Foster CS, Perry HD. Schirmer test after topical anesthesia and the tear meniscus height in normal eyes. *Arch Ophthalmol*. 1979;97(6):1082–5.
16. Whitcher JP, Shiboski CH, Shiboski SC, Heidenreich AM, Kitagawa K, Zhang S, et al. A simplified quantitative method for assessing keratoconjunctivitis sicca from the Sjögren's Syndrome International Registry. *Am J Ophthalmol*. 2010;149(3):405–15.

Author biography

Kruthika S, Final Year Resident https://orcid.org/0000-0002-8188-4367

Usha B R, Assistant Professor https://orcid.org/0000-0001-7019-1293

Cite this article: Kruthika S, Usha B R. Effect of manual small incision cataract surgery on pre-corneal tear film at a tertiary care centre. *Indian J Clin Exp Ophthalmol* 2023;9(2):145-150.