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Original Research Article

Influence of Manual Small Incision Cataract Surgery on Pre-Corneal Tear Film

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Abstract:

Introduction: Dry eye disease (DED), which affects postoperative patient satisfaction and resulting in subpar visual acuity, is a typical adverse effect following cataract surgery. During cataract surgery, the tear film is disturbed, which causes dry eye illness. There are incredibly few studies that evaluate dry eye after manual small incision cataract surgery (MSICS) in the South Indian population. Consequently, this study was carried out to assess the tear film after manual small incision cataract surgery and to ascertain the occurrence of dry eye.

Materials and Methods: In order to evaluate the severity of dry eye following MSICS, a prospective study was conducted in the Department of Ophthalmology at Jawahar Lal Nehru Medical College and Hospital. Dry eye indices used were tear meniscus height, tear film break up time, Schirmer's Test 1, and Rose Bengal staining. Preoperatively, as well as a week, a month, and three months after surgery, the patients were evaluated.

Result: 67 (33.3%), 83 (41.3%), and 6 (3.2%) of patients who underwent manual small incision cataract surgery suffered mild, moderate, and severe dry eyes, respectively, in the first week after the procedure. 70 eyes (34.9%), 60 eyes (30.2%), and 3 eye (1.6%) experienced mild, moderate, and severe dry eyes, respectively, one month following MSICS surgery. At the one-week and one-month postoperative reviews, the mean dry eye indices were significantly lower than they were preoperatively, which was typical.

Conclusion: Following cataract surgery, the dry eye condition started to appear right away and peaked on day seven. Dry eye symptoms were shown to lessen over time. Dry eye sickness is a common post-cataract surgery complaint that, despite a normal visual recovery, has a negative impact on patient satisfaction and needs to be quickly diagnosed and treated.

Keywords: Cataract surgery, TMH, Schirmer test, Rose Bengal test.

Introduction

In India, cataract continues to be the main cause of blindness in those over the age of 50. [1] As a result of the recent two-year slowdown in surgeries, the cataract backlog has grown even more, and the Indian government has recommended raising the number of procedures from 75 lakhs in 2022–2023 to 105 lakhs in 2024–25.[2] Phacoemulsification (PE) and manual small-incision cataract surgery (MSICS) are the two types of cataract procedures performed today. When it comes to providing community health services in India and other underdeveloped countries, MSICS serves as the foundation due to advanced cataracts and a lack of PE equipment that is accessible to everyone. [3] In India, MSICS is the procedure that is practised the most throughout training for cataract surgery. [4] MSICS has been introduced into residency training programmes even in the United States due to its safety in very dense cataracts. [5]

Cataract surgery is one of the most successful surgical procedures due to the great improvement in everyday activities, lower mortality, and immediate increase in visual acuity. Dry eye disease (DED), which affects postoperative patient satisfaction and resulting in subpar visual acuity, is a typical adverse effect following cataract surgery. 4 Dry eye is one of the main factors affecting the quality of life (QOL) of elderly people. [5]

Three-quarters of blindness in the poor world is caused by cataracts, which are the main cause. Complete or partial opacification of the human lens or its capsule is known as a cataract. [1] Over the past 15 years, phacoemulsification has replaced surgery to remove cataracts as the method of choice. Because of the little incision, reduced post-operative astigmatism, and early refraction stabilisation, it is favoured [2,3]. However, in situations when high volume surgery with inexpensive instrumentation is essential, MSICS is a reasonable substitute for phacoemulsification. The technique can be carried out on dense cataracts and is quick and less complication [2,3].

The primary goals of these procedures are to achieve early visual rehabilitation and improved unaided visual acuity with the fewest possible surgical consequences [7-8]. Our study comprised two commonly used cataract extraction methods: phacoemulsification (Phaco) and manual small incision cataract surgery (MSICS). The reduction in incision size has been a major factor in the progress of surgical methods.

Materials and Methods:

This prospective study included 200 patients with cataracts who were scheduled for manual small incision surgery in the Department of Ophthalmology at Jawahar Lal Nehru Medical College and Hospital in Bhagalpur, Bihar between January 2023 and June 2023.

Data on patients with senile cataracts were gathered from the Ophthalmology outpatient department. Each patient had a smooth manual SICS procedure using a superior or temporal sclerocorneal incision.

Patients who were older than 60 were included. The study excluded patients with pre-existing ocular diseases like glaucoma, uveitis, disorders of the lid or nasolacrimal pathway, ocular allergies, pterygium, and previous ocular surgeries as well as those with surgical complications, pre-existing dry eyes, Sjogren's syndrome, rheumatoid arthritis, and other autoimmune disorders.

Patients who missed follow-up were not included.

A thorough anterior segment evaluation using slit lamp biomicroscopy was included of the clinical examination to rule out any pre-existing ocular surface diseases. In all patients, TMH, TBUT, ST1, and RB staining were performed.

One day prior to surgery, the patients' topical antibiotic regimen was initiated. 90 minutes prior to cataract surgery on the scheduled procedure day, pupils were dilated using drops containing 10% phenylephrine hydrochloride and 0.8 mg tropicamide.

Under peribulbar block, a manual tiny incision cataract surgery was carried out using either a superior or temporal sclerocorneal tunnel. The incision was 1.5 to 2 mm from the limbus and 6 to 6.5 mm long. All patients received an intraocular lens implant made of rigid PMMA. Every patient adhered to the same postoperative regimen. For eight weeks, all patients received a topical steroid and antibiotic combination in titrating doses. Post-operative assessments were performed at 1 week, 1, 2, and 3 months. TMH, TBUT, ST1, and RB staining were carried out with each visit.

Under the slit lamp's restricted field of view, the tear meniscus height was noted as normal or low. After applying 2% fluorescein dye, the precorneal tear film was examined for the presence of debris (mucous, oil droplets, and debris). The TBUT counts the time between the last full blink and the first randomly placed dry patch over the cornea. The readings were taken with a cobalt blue filter at the slit lamp. The average of three TBUT values was computed.

TBUT dry eye was defined as lasting fewer than 10 seconds.

Using 5 minute by 35 mm sterile strips of Whatman No. 41 filter paper, Schrimer's test (ST-1) was conducted. By placing a Schirmer paper strip at the intersection of the medial and lateral third of the lower fornix for five minutes, ST1 was assessed. Dry eyes are those that have less than 10 mm of wetting.

Rose Bengal Stain (RB):

Ocular surface damage is measured using the Rose Bengal stain. The inferior cul de sac was treated with a sterile, commercially available Rose Bengal strip that had been soaked with 4% xylocaine. The eye was checked for corneal and conjunctival staining after 15 seconds with red free light or bright light using a slit lamp. Based on a scale of 0 to 3, the cornea and conjunctiva staining of the nasal, temporal, and cornea were all scored using the Van Bijsterveld grading system. A positive test result was defined as an eye additive score of 4 or higher.

The categorization of dry eye cases and their presence was shown as categorical data. There were three categories used: mild, moderate, and severe dry eye. Mild dry eye is defined as having ST1 less than 10 mm in 5 minutes, TBUT less than 10 s, and less than 1 quadrant of Rose Bengal staining on the cornea. A TBUT of 5–10 s and ST1 of 5–10 mm in 5 min, along with punctate staining of more than one corneal epithelial quadrant by Rose Bengal, are included in the classification of moderate dry eye. When there is severe dry eye, the conjunctival epithelium is defined as diffuse punctate or confluent staining with ST1 less than 5 mm in 5 minutes and TBUT less than 5 seconds

A diffuse punctate or confluent staining with Rose Bengal, typically with filaments, was documented for the corneal epithelium.

Data was entered into Microsoft Excel 2019 and evaluated with SPSS version 21 software.

Frequencies (Mean Standard deviation) and proportions were used to represent categorical data and continuous data, respectively. The paired T-test for continuous variables was used to examine the paired values (pre- and post-op) for associations. Chi-square test (for categorical data) and independent Ttest (for continuous variables) were used to assess the test of association. Statistics were considered significant if P 0.05.

Results:

To evaluate the precorneal tear film, 200 cataract patients scheduled for manual small incision surgery participated in this study. The participants' average age, which ranged from 61 to 84 years, was 63.01 ± 8.261. There is a normal distribution by age group.

In this study, 64% of males and 36% of women took part. The usual meniscus tear height was between 0.3 and 0.6. After one week, one month, and three months following the post-operative day, the mean TMH values range from0.195 ± 0.152, 0.304 ± 0.164, and 0.362 ± 0.142, respectively. In the first week, first month, and third month following surgery, the mean Schirmer's test values ranged from 11.65 ± 4.520, 13.94 ± 6.601 and 26.89 ± 4.651 respectively. After the postoperative day, one week, one month, and three months later, the mean tear film breaks up times varied from 8.35 ± 1.615, 8.22 ± 2.244 and 21.33 ± 3.644, respectively.

Comparison of Pre-Operative and Post-Operative Findings:

Tear meniscus height:

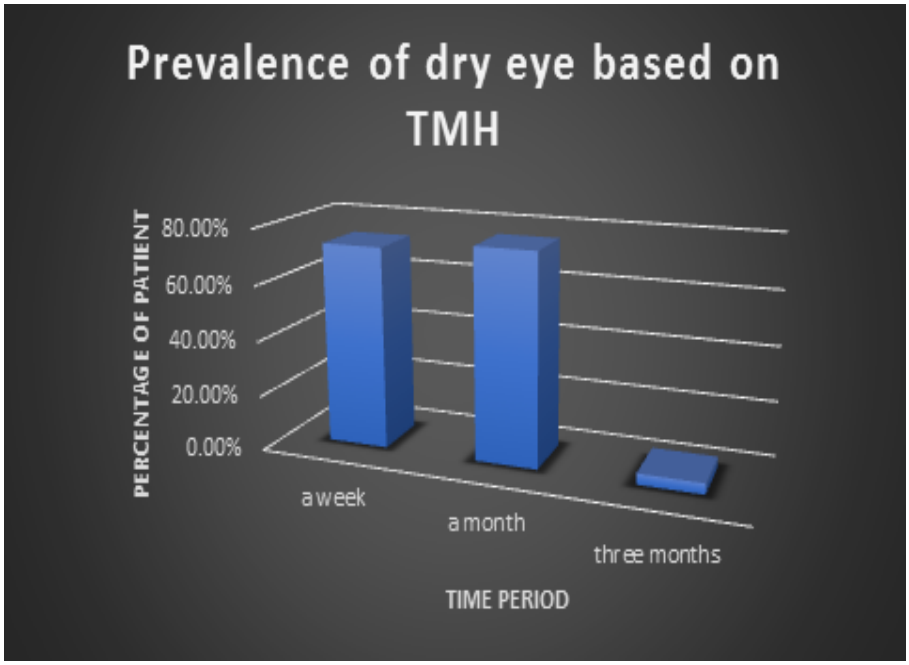

Figure 1: Prevalence of dry eye based on TMH

The mean value of the torn meniscus height decreased on the first postoperative weekday (0.195±0.152) and the first postoperative month day (0.304±0.164), and this value was statistically significant. Additionally, it was decreased after three months following surgery (0.362 ±0.142), but the difference was not statistically significant.

Schirmer test: At the review one week after surgery (11.65±4.520), and at the review one month after surgery (13.94±6.601), the mean value of Schirmer's test results had decreased, and this value was significant. Additionally, it decreased three months after the post-operative day (26.89±4.651), and the value was statistically significant.

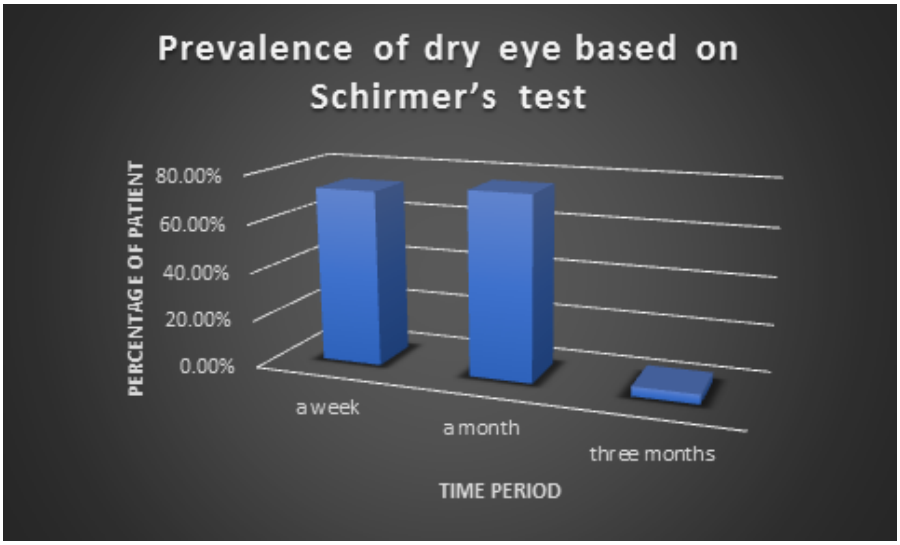

Figure 2: Prevalence of dry eye based on Schirmer's test

Tear film break up time: It was significant that the mean tear film break up time was shorter one week and one month after surgery (8.35 ± 1.615 and 8.22 ± 2.244, respectively). Additionally, it was increased at the three-month review (21.33 ± 3.644), and the value was substantial.

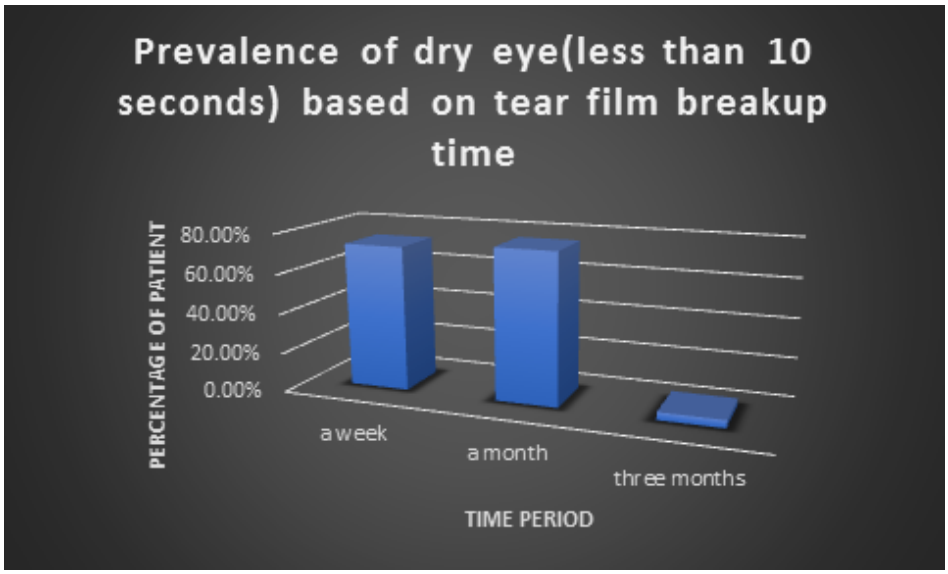

Figure 3: Prevalence of dry eye(less than 10 seconds) based on tear film breakup time

Rose Bengal test: At one week and one month after surgery, the mean score on the Rose Bengal test showed a statistically significant difference. Comparing the scores to the preoperative period, they were noticeably higher. Patients were considered to have dry eyes if they had two positive clinical tests (TBUT of 10 seconds, ST1 score of 10 mm, and statin score of >4). Mild dry eyes are defined as patients who have ST1 less than 10 mm in 5 minutes, TBUT less than 10 seconds, and less than one quadrant of corneal staining by RB. TBUT of 5 to 10 seconds, punctate staining of more than one corneal epithelial quadrant by RB, and ST1 of 5 to 10 mm in 5 minutes are all indicators of moderate dry eye. Severe dry eye is characterised by diffuse punctate or confluent staining (with RB), frequently accompanied by filaments, of the corneal epithelium with ST1 less than 5 mm in 5 minutes and TBUT less than 5 seconds.

Following MSICS, mild, moderate, and severe dry eyes were each experienced by 67 (33.3%), 83 (41.3%), and 6 (3.2%) eyes, respectively. A month following MSICS surgery, mild, moderate, and severe dry eye, respectively, were present in 70 eyes (34.9%), 60 eyes (30.2%), and 3 eye (1.6%).

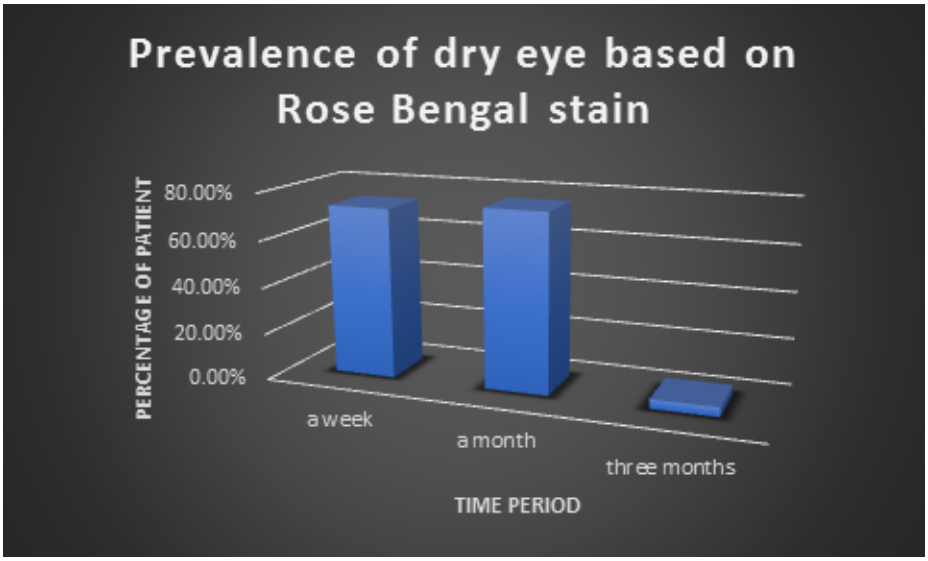

Figure 4: Prevalence of dry eye based on Rose Bengal stain

Discussion

The Latin term "keratoconjunctivitis sicca" refers to dry eye illness or dry inflammation of the cornea and conjunctiva. The expression was first coined by Swedish ophthalmologist Henrik SC Sjogren and was resurrected as "dry eye" by Andrew De Roetth in 1950 [9]. Inadequate tear production or excessive tear evaporation causes dry eye, a tear film disorder that affects the interpalpebral ocular surface and is associated with ocular discomfort. The Tear Film and Ocular Surface Society (TFOS) recently updated its definition of dry eye to include the following: Dry eye is a multifactorial condition of the tears and ocular surface that presents with symptoms of pain, blurred vision, and tear film instability as well as the possibility of ocular surface injury [10].

Along with it, the ocular surface swells up and the osmolarity of the tear film rises. [11] A dry eye can develop as a side effect of surgical procedures when the sensory nerves on the surface of the eye are unavoidably injured. In the absence of precise sensory perception, the corneal feeling decreases, which lowers basal and reflex tearing as well as blinking frequency.

Furthermore, sensory denervation will stop the lacrimal gland from secreting tears, lowering tear production. Following cataract surgery, the lipid layer of the tear film may decrease and become unstable, resulting in dry eyes. It's possible that postoperative corneal nerve damage is to blame for the diminished tear output. The cornea contains the highest density of sensory nerve endings in the human body. Following the transection of these nerves, it is possible for cytoskeletal structures to be lost, permeability to increase, metabolic activity to decrease, and epithelial wound healing to be compromised. Clinically, a decrease in tear production is followed by a decrease in corneal sensitivity, which causes dry eyes with insufficient aqueous tears [12, 13]. Goblet cells secrete the tear film's mucinous component. Therefore, a decrease in mucin-producing cells could compromise the integrity of the tear film and cause an evaporative dry eye.

The goblet cells that lubricate the eye may become less effective if they are exposed to the focused light of a microscope used by ophthalmic surgeons. Different studies have different levels of dry eye prevalence [10-13]. Dry eyes developed in MSICS patients one week, one month, and three months after the procedure, checking was done.

Based on Schirmer's test1 (less than 10mm), the current study revealed that 55.6%, 44.4%, and 3.2% of patients experienced dry eye during the first week, month, and three months following surgery. Our investigation showed that within the first week, one month, and three months following the postoperative period, 66.7%, 44.4%, and 19% of patients, respectively, had low TMH based on (0.2). Based on tear film break up time (low TBUT 10 sec) during one week, one month, and three months after the post-operative period, our study found that 73%, 76.2%, and 4.8% of patients experienced dry eye.

Based on Tear Meniscus height (0.2) at one week, one month, and three months following surgery, 66.7%, 44.4%, and 19% of patients, respectively, experienced dry eye. According to Schirmer's test (less than 10 mm), 55.6%, 44.4%, and 3.2% of patients experienced dry eye within the first week, month, and three months following surgery. Based on tear film break up time (less than 10 seconds) during one week, one month, and three months after the postoperative period, 73%, 76.2%, and 4.8% of patients had dry eye. Based on Rose Bengal staining, 82.5%, 84.1%, and 41% of eyes had dry eyes in the

postoperative period of one week, one month, and three months, respectively.

67 (33.3%), 83 (41.3%), and 6 (3.2%) eyes, all suffered mild to moderate to severe dry eyes during the first week after MSICS, respectively70 eyes (34.9%), 60 eyes (30.2%), and 3 eyes (1.6%) experienced mild, moderate, and severe dry eyes, respectively, one month following MSICS surgery. The mean value of the tear meniscus height decreased from its preoperative value of 0.4102 ± 0.118 to 0.215 ± 0.143 and 0.294 ± 0.144 at one week and one-month postoperative days, respectively. This value was statistically significant. Additionally, it decreased on the third post-operative day (0.363 ± 0.153), but the difference was not statistically significant. The mean value of the Schirmer's test findings decreased significantly from the pre-operative value (28.06 ± 2.094) one week after the operation (11.35 ± 4.820) and one month after the operation (13.52 ± 6.701). Additionally, it was decreased three months after the operation (26.78 ± 4.531), and the value was considerable. The mean value of tear film break up time results decreased significantly from the preoperative value (22.49 ± 2.078) one week and one month after the operation (8.25 ± 1.606 and 8.33 ± 2.155, respectively). Additionally, it was decreased on the third post-operative day (21.22 ± 3.594) and the value was substantial. In the postoperative periods of one week, one month, and three months, there was a statistically significant difference in the Rose Bengal test's mean score. In comparison to the preoperative period, the scores were noticeably higher.

Schirmer's test was used to classify the dry eye into mild (less than 10 mm), moderate (5-9 mm) and severe (less than 5 mm). Mild dry eye was present in 7.9% and 4.8% of patients one week and one month after surgery, respectively. Moderate dry eye was present in 55.6%, 44.4%, and 3.2% of patients one week, one month, and three months after surgery. Based on the time it took for the tear film to break up, dry eye was divided into three categories: mild (less than 10 seconds), moderate (5-9 seconds), and severe (less than 5 seconds). Mild dry eye was present in 27% and 22.2% of patients one week and one month after surgery, respectively. Moderate dry eye was present in 73%, 76.2%, and 4.8% of patients one week, one month, and three months after surgery, respectively. According to Rose Bengal staining, 54% of patients had mild dry eye, 12.7% had moderate dry eye, and 15.9% had severe dry eye one week following the postoperative period. In a one-month post-operative follow-up period, according to Rose Bengal staining, 57.1%, 15.9%, and 11.1% of patients had mild, moderate, and severe dry eye, respectively. Even three months into the postoperative follow-up period, 41.3% still experienced mild dry eye.

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.

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