

Changes in the Tear Film after Manual Small Incision Cataract Surgery – A Prospective Study

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Abstract

Purpose: The purpose was to study dry eye following manual small-incision cataract surgery (SICS) by analyzing the changes in tear film and diagnostic tear film tests following cataract surgery.

Study Design: This is a prospective study.

Material and Methods: The present study is a hospital-based study which was carried out over a period of 1 year starting from April 2018 to March 2019. In this study, 50 patients of age group 31–80 years, who were diagnosed with senile cataract were observed. All underwent uncomplicated manual SICS and followed up for the period of 3 months. All selected patients were studied for any abnormalities in tear film before and after manual SICS. The various tear film tests done were tear meniscus height (TMH), tear film breakup time (TBUT), Schirmer's test 1 (ST1), and rose bengal staining (RB). The tests were done on all the patients 1 day before and 1 day, 1 month, and 3 months post-cataract surgery.

Results: In the present study, majority (50%) of the study participants were aged between 61 and 70 (years) and 18% were aged between 71 and 80 (years). In the present study, 70% of the participants were males and 30% were females. All dry eye test values were significantly worse post-cataract surgery in the 3-month follow-up period; TMH analysis showed that 22 (44%), 38 (76%), and 31 (62%) had low TMH at post-operative 1 week, 1 month, and 3 months, respectively, which was statistically significant. The TBUT analysis showed that at post-operative 1 week, 1 month, and 3 months, 18 (36%), 23 (46%), and 18 (36%) had low TBUT values. 21 (42%), 26 (52%), and 9 (18%) had low ST1 values at post-operative 1 week, 1 month, and 3 months, respectively. RB stain analysis showed at 1 week, 1 month, and 3 months, post-operatively 21 (42%), 26 (52%), and 9 (18%), respectively, patients had abnormal value. Statistically significant difference in TMH, ST1, TBUT, and RB staining between pre-operative, post-operative 1 week, 1 month, and 3 months has been seen.

Conclusion: Manual SICS is capable of inducing dry eye, and patients should be educated about the dry eyes after cataract surgery and be assessed for dry eyes pre-operatively.

Key words: Dry eye, Schirmer's test, Small-incision cataract surgery, Tear film breakup time

INTRODUCTION

Dry eye is a multifactorial disease of the tears and ocular surface which results in symptoms of discomfort, visual disturbance, and tear film instability, with possible damage to the ocular surface.^[1] It is accompanied by an increased

osmolarity of the tear film and inflammation of the ocular surface. The causes of dry eyes are abnormalities of the tear film itself, i.e., aqueous tear deficiency, mucin deficiency, lipid abnormalities and lid surfacing abnormalities, and epitheliopathies. The epithelial injury which is caused by dry eye excites the corneal nerve endings which leads to symptoms of discomfort, increased frequency of blinking, and possibly, compensatory reflex lacrimal tear secretion. Ultimately, the chronic surface damage of the dry eyes leads to a reduced corneal sensitivity and reflex tear secretion. Risk factors for the development of dry eye syndrome are aging, connective tissue disease, history of allergy and use of antihistamines, cataract surgery, refractive surgery, and diabetes.^[2-6]

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Many patients after cataract surgery complained of dry eye and symptoms of irritation post-operatively. One or more of the above-mentioned contributory factors could be involved in the pathogenesis of dry eye in patients of post-cataract surgery. Furthermore, the application of topical eye drops, impaired corneal sensitivity, and surgery-related inflammation such as a large incision created in the eye, and microscope light exposure time during surgery are thought to be responsible for post-operative tear film dysfunction.^[7-10] The environmental exposure to wind, sunlight, and high temperature is other contributing factors for dry eyes, which can be aggravated after cataract surgeries.

In a developing countries like ours, the most efficient and the economical means of doing a cataract surgery is manual small-incision cataract surgery (SICS) with a corneoscleral tunnel incision. Now-a-days, even the base camp surgeries which are done under the National Program for Control of Blindness are manual SICSs with corneoscleral tunnel incisions. Despite high prevalence of dry eye, it is frequently under-recognized. Due to its influence on patients' visual function and quality of life, dry eye represents a big burden in public healthcare. Hence, there was a need to evaluate the dryness of the eyes which manifests after the manual SICSs with corneoscleral tunnel incisions.

MATERIALS AND METHODS

It was a hospital-based prospective study carried out in the Department of Ophthalmology, ASCOMS BATRA, Jammu, over a period of 1 year starting from April 2018 to March 2019. In this study, 50 patients of age group 31–80 years who were diagnosed with senile cataract were observed. All underwent uncomplicated manual SICS. The incision was made superiorly in all the cases. Ethical clearance was obtained from institutional ethical committee.

Inclusion Criteria

All grades of senile cataract. The patient who came for uneventful cataract surgery was included in the study.

Exclusion Criteria

Patients who have (1) dry eyes, (2) Sjogren's syndrome, (3) glaucoma, (4) uveitis, (5) disorders of lid and nasolacrimal pathway, (6) ocular allergy, and (7) previous ocular surgery were excluded from the study.

All patients underwent complete ophthalmological examination which included visual acuity using Snellen's chart, best corrected visual acuity, slit lamp examination, intraocular pressure, fundus examination, indirect ophthalmoscope, tear meniscus height (TMH), tear film breakup time (TBUT), Schirmer's test 1 (ST1), and rose bengal (RB) staining.

Technique

TMH

TMH was recorded as normal or low (under narrow beam of slit lamp).

TBUT measurement

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

ST 1

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

RB stain

It is a measure of assessing ocular surface damage. A sterile, commercially available RB strip moistened with 4% Xylocaine was applied to the inferior cul de sac. After 15 s, 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.

Dry eye was defined as having one or more symptoms (often or all the time present), along with one or more positive clinical findings (based on slit lamp examination) and one or more positive clinical tests (TBUT of = 10 s, ST1 score = 10 mm, RB stain score of >4). Asymptomatic patients with positive signs or positive tests were considered as having dry eye and were included in the study. Dry eye was graded as mild, moderate, and severe. Mild dry eye can be defined in patients with ST1 of <10 mm in 5 min, TBUT <10 s, and <1 quadrant of staining of the cornea by RB. Moderate dry eye is defined as ST1 of 5–10 mm in 5 min and TBUT of 5–10 s with punctate staining of more than one quadrant of the corneal epithelium by RB. Severe dry eye is defined as diffuse punctate or confluent staining (with RB) of the corneal epithelium, often with filaments and diffuse punctate or confluent staining of the conjunctival epithelium with ST1 <5 mm in 5 min and TBUT <5 s.

RESULTS

50 patients were followed for 3 months after cataract surgery and assessed for the development of dry eye on

Paired samples test

| TBUT test pre and post cataract surgery | | | Paired differences | | t | df | P-value | |
|---|---------|----------------|--------------------|---|---------|--------|---------|---------|
| | Mean | Std. Deviation | Std. Error Mean | 95% confidence interval of the difference | | | | |
| | | | | Lower | | | | Upper |
| Pre-TBUT – Post-TBUT 1 w | 4.90000 | 1.40335 | 0.19846 | 4.50117 | 5.29883 | 24.690 | 49 | <0.0001 |
| Pre-TBUT – Post-TBUT 1 m | 5.22000 | 1.70581 | 0.24124 | 4.73521 | 5.70479 | 21.638 | 49 | <0.0001 |
| Pre-TBUT – Post-TBUT 3 m | 4.62000 | 1.98864 | 0.28124 | 4.05483 | 5.18517 | 16.427 | 49 | <0.0001 |

TBUT: Tear film breakup time

Table 1: Distribution of study participants according to age

| Age (years) | Number of patients (%) |
|-------------|------------------------|
| 31–40 | 2 (4) |
| 41–50 | 6 |
| 51–60 | 8 (16) |
| 61–70 | 25 (50) |
| 71–80 | 9 (18) |

the basis of TMH, ST1, TBUT, and RB staining of ocular surface. In the present study, majority (50%) of the study participants were aged between 61 and 70 (years) and 18% were aged between 71 and 80 (years) [Table 1]. In the present study, 70% of the participants were males and 30% were females. TMH analysis showed that pre-operatively 5 patients (10%) had abnormal TMH values. 22 (44%), 38 (76%), and 31 (62%) had low TMH at post-operative 1 week, 1 month, and 3 months, respectively, which was statistically significant. The TBUT analysis showed that pre-operatively 1 (2%) patient had low TBUT values. At post-operative 1 week, 1 month, and 3 months, 18 (36%), 23 (46%), and 18 (36%) had low TBUT values. ST1 analysis was normal in all patients pre-operatively, whereas 21 (42%), 26 (52%), and 9 (18%) had low ST1 values at post-operative 1 week, 1 month, and 3 months, respectively. RB stain analysis showed normal values pre-operatively while at 1 week, 1 month, and 3 months, post-operatively 21 (42%), 26 (52%), and 9 (18%), respectively, patients had abnormal value. Statistically significant difference in TMH, ST1, TBUT, and RB staining between pre-operative, post-operative 1 week, 1 month, and 3 months has been seen.

DISCUSSION

Various studies have been done that have compared the pre-operative and post-operative changes in dry eye symptoms after cataract surgery.^[11,12] In one study conducted by Li *et al.*, it was found that after cataract surgery, the incidence of dry eye was increased dramatically as BUT

and STI decreased in patients after cataract surgery.^[8] Liu *et al.* also reported significant worsening of the tear film, TMH, TBUT, ST1, and corneal fluorescein staining after phacoemulsification.^[13] The results of these studies are comparable with our study. However, a study conducted by Ram *et al.* revealed no differences in dry eye before and after phacoemulsification surgery among 23 patients when the TBUT and ST1 with anesthesia were performed. The reason for the inconsistency may be due to its small sample size and retrospective study design.

In our study, the TMH values were found to be the lowest at 1 month, while it showed minor improvement at 3 months while study done by Cho *et al.* found that TMH value reduced in all the follow-up visits.^[12] Gharaee *et al.* also showed the reduced TMH value at 3-month post-operative visit. In the present study, TBUT value was lowest at 1 month (10.32 s-mean value) while it showed slight improvement at 3-month post-operative which is consistent with the studies done by Chandan *et al.* and Mohan *et al.* In the present study, all of the patients had normal ST1 values pre-operatively, whereas post-operatively 21 (42%), 26 (52%), and 9 (18%) had low ST1 values at post-operative 1 week, 1 month, and 3 months, respectively. The results are consistent with the other studies.^[12,14] In the present study, no patient had abnormal RB staining pre-operatively whereas at 1 week, 1 month, and 3 months, post-operatively 21 (42%), 26 (52%), and 9 (18%), respectively, patients had abnormal value which has also been seen in the study done by Oh *et al.*^[15] After 3 months, the severity of dry eye decreased but never returned to baseline levels.

Park *et al.* in 2016 evaluated meibomian gland function, changes of lacrimal tears, and ocular surface parameters and tear inflammatory mediators following cataract surgery of 48 eyes among 34 patients. Patients were divided into 2 groups: those who had pre-existing dry eye before cataract surgery and those who did not. It was found in the results that compared with the no dry eye group, dry eye group revealed significantly higher

ocular symptom scores, lower TBUT, higher lid margin abnormalities, meibum quality, and expressibility scores after cataract surgery.^[16] Similarly, Han *et al.* in 2014 evaluated dry eye and meibomian gland dysfunction after cataract surgery and found that ocular symptom scores were worse at 1 month and 3 months post-operatively while lid margin abnormalities were significantly increased and TBUT decreased post-operatively. Meibum expressibility decreased at 3 months post-operatively however, meibography score, SPK, lower TMH, depth and area, and the ST did not change significantly post-operatively.^[9]

Limitations of the study were that the sample size was small, short follow-up of the post-operative patients, and meibomian gland function was not completely reviewed as it requires us to lower the lid which could reopen the corneal incision, and blood sugar levels were not determined.

CONCLUSION

We concluded that dry eye symptoms can develop immediately after cataract surgery and the severity can peak on day 7. Both symptoms and signs of dry eye can improve over time. Therefore, patients should be educated about the dry eyes after cataract surgery and assessed for dry eyes pre-operatively. In the present study, although we have observed the improvement in the dry eyes after 3 months cataract surgery, further studies with long follow-up and large sample size are required.

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