Original Article

# Dry Eye Disease Following Cataract Surgery

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**Purpose:** To know the changes in tear film and the presence or absence of Dry eye disease (DED) after cataract surgery.

**Study Design:** Prospective descriptive study.

**Place and Duration of Study:** Federal Government Services Hospital Islamabad**,** Jan.2013-Dec 2013.

**Material and Methods:** The baseline characteristics of 192 patients were recorded and Dry eye (DE) questionnaire was administered by a trained interviewer. Dry eye tests were performed on day 0 (baseline), day 7, 30 and day 90 after phacoemulsification under the same physical conditions by a single surgeon. SPSS version 17 was used and data analyzed for frequencies/percentages. Diagnosis was made on three of five parameters.

**Results:** Of the 192 patients, 121 (63%) patients had dry eyes and 71 (37%) patients did not have any dry eyes. After surgery, symptoms of DE increased but all dry eye tests declined. Maximum change in both sexes was on 7$^{th}$ post-operative day and in those above 60 years of age. Among all patients the height of marginal tear strip was nearly 1 mm and was discarded for grading. On 30$^{th}$ day the tests improved gradually but interestingly preoperative values were not achieved even after sixty days.

**Conclusion:** DE symptoms and signs appeared within seven days which improved later on slowly.

**Key Words;** Dry eye, cataract surgery, corneal nerves, dry eye tests.

Recently, emphasis has been given to dry eye disease following cataract surgery. Before surgery most cases had normal lacrimal secretions. A grooved incision can raise these symptoms during early postoperative period.

Damage to any part of the lacrimal functional unit results in tear film instability and ocular surface damage so dry eyes influence patient's ocular, general health and quality of life[1]. Various studies have shown the DE prevalence to be 13.3% and 21.6% respectively between the ages of 43 and 86 years after 5-10 years of follow-up[2]. In US population, it is 5% to 17% and the incidence of dry eye after phacoemulsification was 9.8%[3]. In the United States alone, about 7-10 million Americans require artificial tear preparation spending over 100 million dollars/year[4].

Dry eyes can develop after different ocular surgeries like photorefractive keratectomy and laser-assisted in situ keratomileusis. Cataract surgery affects the neurogenic response and decreases tear secretions[5].

Cornea has rich innervations having 44 nerve bundles entering around the limbus. Larger nerve fibers enter from 9 to 3 o'clock position[6]. During surgery, temporal corneal incisions reduce the corneal sensitivity[7]. Moreover longer the surgical time the more damage to the corneal nerves. Neurogenic inflammation and inflammatory mediators can reduce corneal sensitivity[8].

After 4 weeks, neural growth factors regenerate the subepithelial corneal neurite cells during healing process of the corneal nerves[9]. This explains the occurrence of DE early after surgery which then improves slowly. The aim of our study was to know tear film changes and the presence or absence of DED after cataract surgery.

## MATERIAL AND METHODS

A prospective descriptive study was conducted at Ophthalmology department, Federal Government Services Hospital Islamabad from Jan. 2013 – Dec. 2013 after taking their consent and permission from Ethical committee.

First operated eyes of one hundred and ninety-two (52% males, 48% females) uncomplicated cataract patients undergoing phacoemulsification with no dry eye symptoms were included. The mean age was 60.07 years with 40-78 years range. Patients with autoimmune diseases, previous ocular surgery/injury, ocular allergies and using topical eye drops were excluded. Patients who developed complications during surgery were also excluded.

Under subtenon anesthesia a standard surgical technique with 2.80 mm superior/temporal corneal incision was used on all patients. After surgery, all patients used tobramycin with dexamethasone eye drops four times daily for four weeks.

Clinical examinations included DE questionnaire (DEQ 5), tear film breakup time (TBUT), Shirmer's test (ST), corneal fluorescein staining (CFS) with Oxford Schema, tear meniscus height (TMH) and slit-lamp examination of lid margin changes based on 'The International Dry Eye Workshop' (DEWS) 2007 guidelines by a single surgeon under same physical conditions. Follow-up was on 7th day, 1 month and 3 months postoperatively. Diagnosis was based on DEQ scores, TBUT values < 10 sec, ST values < 10 mm/5s and CFS staining > 1 and presence of lid plugging and telengiectasias. Data was entered into SPSS version 17 and analyzed for percentages/frequencies.

## RESULTS

Of 192 subjects there were 48% females and 52% males. Majority of patients 110 (57.2%) were from urban areas and most of them, 98 (51%), belonged to age group of 53-65 years. There were 138 (72%) patients who were operated for right eye. Of the 192 patients, 121 (63%) {71 (58.6%) male and 50 (41.4%) females} patients had dry eyes and 71 (37%) patients did not have any dry eyes.

The observations about the dryness of the eyes, if present, were graded according to the DEWS 2007 report. Table 1 shows the baseline characteristics of all the patients. Dry eye symptoms and severity on 7th, 30th and 90th days are shown in Table 2. At the end of the 30th post-operative day, out of 192 patients, 42 (15.4%) had improved TBUT and ST values.

**Table 1:** Baseline characteristics.

| Characters | Number (n = 192) | Percentage |
|---|---|---|
| Age Group | | |
| 40-52 years | 55 | 28.7% |
| 53-65 | 98 | 51% |
| 66-78 | 39 | 20.3% |
| Sex | | |
| Male | 100 | 52% |
| Female | 92 | 48% |
| Residential | | |
| Urban | 123 | 64% |
| Rural | 69 | 36% |
| Operated Eye | | |
| Right eye | 138 | 72% |
| Left eye | 54 | 28% |
| Incision Site | | |
| Superior Incision | 101 | 52.6% |
| Temporal Incision | 91 | 4 7.4% |

**Table 2:** DE scoring on 7th, 30th, 90th day.

| Ocular History | Visit-1 (7 Days) | | Visit-2 (30 Days) | | Visit-3 (90 Days) | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| F.B Sensation | 99 | 51.5% | 82 | 42.7% | 77 | 40% |
| Burning | 98 | 51.4% | 90 | 46.8% | 72 | 37.5% |
| Dryness | 81 | 42.6% | 80 | 41.6% | 67 | 34.9% |
| Watering | 80 | 41.6% | 78 | 41.2% | 77 | 40% |
| Itching | 42 | 21.8% | 41 | 21.6% | 35 | 18.2% |

After cataract surgery all dry eye tests values were low with increased symptoms of patients. There were 12.2% eyes which had grade 4, 21.4% eyes had grade 3, 33.6% had grade 2 and 60 eyes (30.6%) had grade 1 Oxford Schema staining. There were 88 eyes (45.8%) which showed TBUT values below 10 seconds and 45 (23%) eyes showed values < 5s. ST values were below 10 mm/5 seconds in 22 eyes (11.2%) and below 5 mm/5 sec in 17 eyes (8.6%) (Table 3).

**Table 3:** DE positive signs on 7th day.

| Tests | 7th. Day | 30th.Day |
|---|---|---|
| TBUT | 69% | 36% |
| ST | 19.8% | 13% |
| Oxford Schema | 51% | 27% |
| Lid margin | 53% | 31%.2 |
| DEQ 5 | 62% | 29.1% |

The TBUT test was more reliable than the Schirmer test. Maximum change in value in both genders was on 7th day after operation and in subjects over 60 years (Table 4). The height of marginal tear strip in all subjects varied from 0.5 mm to 1 mm so it was discarded for grading. Interestingly 30 days after operation the values gradually improved but even after 60 days of surgery the baseline levels were not achieved.

**Table 4:** Tear film break-up time and schirmer's result analysis on 7th day.

| TBUT | n= | % |
|---|---|---|
| > 15s | 59 | 30.7% |
| < 10s | 45 | 23.4% |
| < 5 sec | 88 | 45.8% |
| Schirmer's test values | | |
| 15 mm | 153 | 80% |
| < 10 mm | 17 | 8.9% |
| < 5 mm | 22 | 11.1% |

## DISCUSSION

The DE disease after cataract surgery has multiple factors. Corneal nerves sections and decreased sensitivity, phototoxic microscopic light, irrigations of the corneal epithelium during operation, increased tear's inflammatory cytokines, use of eye drops preservatives during or after surgery influence dry eye disease after cataract surgery[10].

Cho and Kim mentioned rise of dry eye symptoms after cataract surgery[11]. In Liu's study, symptoms aggravated in both diabetics and non-diabetics which reached preoperative levels in non-diabetic group between 30 and 180 days while they remained high in diabetics even on day 180[12]. In the present study, all were non-diabetics and 62% of them showed enhancement of DE symptoms postoperatively which showed reduction after 60th day.

Hawaian Eye 2011 meeting[13] highlighted the incidence of DE in 272 eyes after cataract surgery showing low TBUT in 60%, low ST values in 21.3% while 50% of eyes had central corneal staining similar to present study showing low TBUT in 69%, ST values in 20% and 51% had CFS, all of which are diagnostic signs of dry eye disease.

Many studies have compared pre and postoperative tear film functions and all have reported change in tear film after surgery. Moon et al.[14] compared 25 eyes before and after surgery and noticed low TBUT and ST values up to 2 months postoperatively. Other study[15] mentioned a similar decrease of both TBUT and ST levels in eyes up to 3 months. Cho and Kim[13] conducted a study in 70 eyes of 35 patients after phacoemulsification showing decline in all three tests upto 3 months. Khanal et al.[16] studied 18 patients and found changed tear physiology and decreased sensitivity immediately after surgery where the tear functions recovered within 1-month. We also found a similar trend where TBUT and ST values started recovering after 1-month but Srinivasan et al.[17] and Gharaee et al. denied any effect of modern surgery on tear film and ocular surface.

Oh et al.[18] compared diabetic cataract patients with equal age-matched non-diabetic cataract patients. Diabetic cataract patients showed reduced tear secretions after phacoemulsification. The postoperative decrease in TBUT was seen in non-diabetics as well, similar to our study which showed the same results after one month.

The possible explanation for reduced TBUT and ST values may be the severing nerves by corneal incision which deteriorates the corneal-lacrimal gland loop producing tear secretions[19].

In our study the TBUT reduction indicated unstable tear film resulting from irregular surface at incision site or from a decreased mucin secretion by the conjunctiva as proposed by Han et al[20].

Operating microscope related phototoxicity was observed in other study[21]. The light exposure caused rise of DE symptoms and signs in Cho's and Kim's[11] study. In our study we did not find any relationship between microscopic light exposure time and DE tests.

Movahedan et al.[22] mentioned that a healthy ocular surface has best visual results in cataract patients. Mild to moderate DE disease may not disturb vision but severe DE disturbs the vision in patients. So a proper preoperative assessment should be done[10].

The present study showed abnormal interpalpebral staining of ocular surface characteristic of DE in contrast to inferior staining which occurs in drug toxicity. The abnormal Oxford Schema grading after cataract surgery may be the result of neurogenic inflammation[23].

In the present study, 101 (52.6%) cases had superior incision while 91 (47.4%) had temporal incision which showed more DE symptoms postoperatively explaining severing of corneal nerve twigs[8].

Benzalkonium chloride containing topical eye drops reduce the number of mucin-expressing cells resulting in tear film instability[24]. Over use of drops affect corneal toxicity and dry eye after surgery. In the present study we did not find the same observations.

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Interpretation, analysis and proof reading.

## CONCLUSION

Our results revealed that Cataract surgery negatively affects the tear film parameters and ocular surface in early postoperative period thus leading to DE. Cataract surgeons can improve their results by treating the ocular surface before and after operation.

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