

## Dry Eye after Cataract Surgery

Gagandeep Kaur\*, Anureet Kaur, Mandeep Kaur and Supriha CN

*\*Department of Ophthalmology, Guru Gobind Singh Medical College, Faridkot, India*

*Received January 21, 2020; Accepted February 11, 2020; Published August 18, 2020*

### ABSTRACT

Dry eye or keratoconjunctivitis sicca is a multifactorial disease which can occur due to various well known risk factors like older age, systemic diseases, environmental factors etc. But nowadays due to increasing ophthalmic surgeries, iatrogenic dry eye is becoming very common. Most common surgery performed in ophthalmology clinics is cataract surgery, so in this article we will review various studies which have concluded that dry eye is common after various cataract surgeries and try to understand the pathogenesis of dry eye after these surgeries.

**Keywords:** Dry eye, Cataract, Phacoemulsification, Tear film, Ocular surface

### INTRODUCTION

Dry eye is common ophthalmological disorder involving disruption of the precorneal tear film caused by either decreased tear film production or excessive tear film evaporation, which causes damage to the ocular surface and is associated with symptoms of ocular discomfort [1]. Although the term dry eye suggests that reduced tear production is the only cause of the problem, there are many ways by which dry eye can occur.

### PATHOGENESIS OF DRY EYE

The ocular surface and tear secreting glands function as an integrated unit to refresh the tear supply and to clear used tears [2]. Disease or dysfunction of this unit results in ocular irritation and dry eye syndrome. Dysfunction may develop from aging, a decrease in supportive factors (like androgen hormones), systemic inflammatory diseases (like rheumatoid arthritis), ocular surface diseases (e.g. herpes zoster ophthalmicus), surgery that disrupts the trigeminal afferent sensory nerves (including LASIK, extra capsular cataract extraction, phacoemulsification or penetrating keratoplasty) and systemic diseases or medications that disrupt the efferent cholinergic nerves that stimulate tear secretion [3]. As shown by studies utilizing topical anesthetic, interruption of the afferent stimulus of tear production or sensory loss (denervation), results in decreased tear secretion and reduced blink rate [4,5]. Damage to afferent sensory fibers occurs after incisional corneal surgery (penetrating keratoplasty, radial keratotomy and limbal cataract incision) and after damage to the first division of the trigeminal ganglion from trauma, tumor, herpes simplex or zoster resulting in reduced tear production.

### SYMPTOMS/OCULAR MANIFESTATIONS

Regardless of the cause, most forms of dry eye share similar symptoms, like dryness, burning and sandy-gritty eye irritation that get worse as the day goes on [6,7].

Because the blinking coats the eyes with tear, symptoms are worsened by activities in which the rate of blinking is reduced due to prolonged use of the eyes like prolonged reading, computer usage, driving or watching television.

Most people who have dry eyes experience mild irritation with no long effects. However if the condition is left untreated or becomes severe, it can produce complications that can cause eye damage, resulting in impaired vision or rarely in the loss of vision [8].

### REVIEW OF LITERATURE

Dry eye is a multifactorial, heterogeneous disorder of the precorneal tear film because of tear deficiency or excessive tear evaporation which causes symptoms of ocular discomfort [9].

---

**Corresponding author:** Gagandeep Kaur, Department of Ophthalmology, Senior Resident, Guru Gobind Singh Medical College, Faridkot, India, E-mail: dr.gagan\_simmy@yahoo.co.in

**Citation:** Kaur G, Kaur A, Kaur M & Supriha CN. (2020) Dry Eye after Cataract Surgery. *Ophthalmol Clin Res*, 3(2): 153-156.

**Copyright:** ©2020 Kaur G, Kaur A, Kaur M & Supriha CN. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## DRY EYE AFTER CATARACT SURGERY

Oh T et al. [10] conducted a study to evaluate changes in corneal sensitivity, tear film function and ocular surface stability in patients after cataract surgery. It was observed that corneal sensitivity at the center and temporal incision sites had decreased significantly postoperatively. However, the sensitivity returned to almost the preoperative level 1 month postoperatively.

Cho YK et al. [11] performed a study to investigate changes in dry eye symptoms and diagnostic test values after cataract surgery. They measured tear break up time, Schirmer I test, tear meniscus height and subjective dry eye symptoms and evaluated the postoperative changes in these values. The correlations between these values and microscopic light exposure time, phacoemulsification energy, the influence of corneal incision location and shape were investigated. They concluded that a grooved incision can aggravate the symptoms during the early postoperative period in patients without dry eye preoperatively. Long microscopic light exposure times can have an adverse effect on dry eye test values.

Liu Z et al. [12] conducted a study to evaluate tear film changes after phacoemulsification. Various dry eye tests were done pre and post operatively. It was concluded that phacoemulsification significantly alters the tear break-up time, Schirmer I value, corneal fluorescein staining, tear film pattern and the height of tear meniscus. Some patients with normal tear film may experience dry eye after surgery. Patients with pre-existing tear break-up time <10 s are easily at risk of experiencing the tear film instability postoperatively.

Li XM et al. [13] conducted a study to evaluate dry eye and analyze pathogenic factors in patients after cataract surgery. They observed that dry eye can develop or deteriorate after cataract surgery, if not treated in time. Misuse of eye drops is one of the major pathogenic factors that causes dry eye after cataract surgery.

Ram J et al. [14] conducted a retrospective study to evaluate the potential causes of postoperative complications and the visual outcome after surgery, for age related cataract in dry eyes. Patients were assigned to 1 of 2 groups: Dry eye with probable secondary Sjögren's syndrome (Group 1); dry eye without connective tissue disorders (Group 2). It was concluded that cataract surgery in dry eyes had fewer complications and better visual outcome in patients, who did not have connective tissue disease than in those who did.

Han KE et al. [15] conducted a study to evaluate dry eye and meibomian gland dysfunction after cataract surgery. Ocular symptom scores, lid margin abnormalities, superficial punctate keratopathies (SPKs), tear film break-up time

(TBUT), Schirmer test, lower tear meniscus height, depth and area using Fourier domain optical coherence tomography, meibum expressibility and images of the meibomian glands using meibography were measured. It was observed that the ocular symptom scores were worse, lid margin abnormalities were significantly increased, meibum expressibility and TBUT decreased postoperatively. However, meibography score, SPK, lower tear meniscus height, depth and area and the Schirmer test did not change significantly postoperatively. It was concluded that meibomian gland function may be altered without accompanying structural changes after cataract surgery.

Khanal S et al. [16] conducted a study to identify any changes in corneal sensitivity and tear physiology after phacoemulsification and to evaluate the effectiveness of the use of ophthalmic lubricants. Tear production, evaporation, lipid layer interferometry and osmolality along with corneal sensitivity were measured before and after the surgery. They observed that saline and the tear lubricants were not effective in improving tear physiology and corneal sensitivity post-surgery and concluded that deterioration in corneal sensitivity and tear physiology is seen immediately after phacoemulsification. Corneal sensitivity does not return to preoperative levels until 3 months postoperatively whereas the tear functions recover within 1 month [16].

Chung YW et al. [17] evaluated the effectiveness of cyclosporine 0.05% for dry eye after cataract surgery. Patients diagnosed with dry eye syndrome, 1 week after cataract surgery, received a twice-daily treatment of cyclosporine 0.05% for one eye and normal saline 0.9% for the other. Disease severity was measured at 2 weeks, 1 month, 2 months and 3 months by Schirmer test I (ST-I), tear film break-up time, corneal temperature and dry eye symptom questionnaire (Ocular Surface Disease Index). It was concluded that cyclosporine 0.05%, can also be an effective treatment for dry eye after cataract surgery.

Munish Dhawan et al. [18] conducted a study to evaluate dry eye after phacoemulsification. Dry eye incidence and pattern were analyzed preoperatively and at days 1, 7, 30 and 90 after phacoemulsification using Ocular Surface Disease Index (OSDI) questionnaire, tear break up time (TBUT), rose Bengal staining, Schirmer I test without anesthesia and Schirmer 2 test with anesthesia. It was observed that seven days after phacoemulsification, the incidence of dry eye was 11%. The severity of dry eye peaked seven days post phacoemulsification which was measured by OSDI questionnaire and clinical tests. Within 30 days and 3 months post-surgery, both the symptoms and signs showed rapid and gradual improvements respectively.

## CONCLUSION

Cataract surgery is the most frequently performed ocular surgery. The etiology of dry eye following cataract surgery

can be due to presence of either pre-existing dry eye or surgically induced dry eye. Various factors may influence the ocular surface environment after cataract surgery. Most important is corneal desensitization [19]. Superficial punctate keratitis, secondary infections like conjunctivitis, keratitis, persistent or recurrent epithelial defects and corneal ulceration have been reported in dry eye patients after cataract surgery notably conventional extra capsular cataract extraction (ECCE) by Ram et al. in 2002 [19].

The dry eye pattern observed after cataract surgery can be due to the recovery process of the corneal nerves. Since the cornea is highly innervated, corneal nerve bundles enter the cornea around the limbus centripetally [20] and some larger nerve fibers run from the 9 o'clock to the 3 o'clock position which then bifurcate to achieve a homogenous distribution over the entire cornea, [21] it is vulnerable to any injury within that region. Temporal corneal incisions created during phacoemulsification can reduce the corneal sensitivity in the surgical area and also other areas away from the incision site [16,22]. The damage to the corneal nerves may increase when a dense cataract is there and longer phacoemulsification time is required to emulsify it [22]. Disruption of the normal corneal innervation (lacrima functional unit feedback) thus reduces the tear flow and blink rate which in return causes instability of the tear film and tear hyperosmolarity [23]. With corneal healing postoperatively, new neurite cells emerge and after 25 days, neural growth factor is released to regenerate the sub epithelial corneal axon [24]. Thus, the recovery of the corneal nerves may explain why the dry eye is seen early after surgery and improves thereafter.

In addition to transaction of the corneal nerves and injury to the corneal epithelial cells, exposure to microscopic light, use of topical anesthesia intra operatively and topical eye drops administered postoperatively and its preservatives can cause dry eye after phacoemulsification [11,13,25,26]. Intraoperative vigorous irrigation of the tear film and manipulation of the ocular surface may decrease the goblet cell density and results in shortened TBUT postoperatively [13]. It is believed that the use of light filters, decreased exposure time, appropriate irrigation and gentle handling of the ocular surface tissue may decrease the postoperative complications.

Moreover, benzalkonium chloride (commonly used preservatives in topical eye drops) can induce tear instability and decrease the number of mucin expressing cells [13,27]. Excessive instillation and incorrect use of preserved eye drops are important factors that contribute to the development of dry eye after phacoemulsification and corneal toxicity.

Mild to moderate dry eye may not affect vision, decreased vision can occur in severe cases. A preoperative assessment should be done properly, if an abnormal ocular surface is detected, the patients are at high risk of developing dry eye

postoperatively. Other clinical tests such as the TBUT, Schirmer test, Rose Bengal and fluorescein staining can be used to screen for dry eye. If dry eye is detected preoperatively, artificial tears or topical cyclosporine A can be prescribed postoperatively [26]. With advanced phaco machines and reduced surgery times, the incidence of dry has decreased over period of time. So inadvertent use of lubricants should be avoided and tear supplements should be prescribed only when required and in patients with risk factors of dry eye.

## REFERENCES

1. Lemp MA (1995) Report of the National Eye Institute/Industry Workshop on Clinical Trials in Dry Eye. *CLAOJ* 21: 221-232.
2. Stern ME, Beuerman RW, Fox RI, Gao J, Mirceff AK, et al. (1998) The pathology of dry eye: The interaction between the ocular surface and lacrimal glands. *Cornea* 17: 584-589.
3. Bacman S, Berra A, Sterin-Borda L, Borda E (2001) Muscarinic acetylcholine receptor antibodies as a new marker of dry eye Sjögren syndrome. *Invest Ophthalmol Vis Sci* 42: 321-327.
4. Collins M, Seeto R, Campbell L, Ross M (1989) Blinking and corneal sensitivity. *Acta Ophthalmol* 67: 525-531.
5. Jordan A, Baum J (1980) Basic tear flow. Does it exist? *Ophthalmology* 87: 920-930.
6. Medscape (2006) Dry eye disease (Keratoconjunctivitis Sicca). The eMedicine, Web MD, Inc. Accessed on: November 12, 2006. Available online at: <http://www.emedicine.com/oph/topic 695.htm>
7. "Keratoconjunctivitis Sicca". The Merck Manual, Home Edition. Merck & Co., Inc. Accessed on: November 12, 2006. Available online at: <http://www.merck.com/mmhe/sec20/ch230d.html>
8. Meadows, Michelle (2005). "Dealing with Dry Eye". *FDA Consumer Magazine*. U.S. Food and Drug Administration, pp: 11-16.
9. Dogru M, Stern M, Smith J, Foulks GN, Lemp MA, et al. (2005) Changing trends in the definition and diagnosis of dry eyes. *Am J Ophthalmol* 140: 507-508.
10. Oh T, Jung Y, Chang D, Kim J, Kim H (2012) Changes in the tear film and ocular surface after cataract surgery. *Jpn J Ophthalmol* 56: 113-118
11. Cho YK, Kim MS (2009) Dry eye after cataract surgery and associated intraoperative risk factors. *Korean J Ophthalmol* 23: 65-73.
12. Liu Z, Luo L, Zhang Z, Cheng B, Zheng D, et al. (2002) Tear film changes after phacoemulsification. *Zhonghua Yan Ke Za Zhi* 38: 274-277.

13. Li XM, Hu L, Hu J, Wang W (2007) Investigation of dry eye disease and analysis of the pathogenic factors in patients after cataract surgery. *Cornea* 26: S16-20.
14. Ram J, Sharma A, Pandav SS, Gupta A, Bambery P (1998) Cataract surgery in patients with dry eyes. *J Cataract Refract Surg* 24: 1119-1124.
15. Han KE, Yoon SC, Ahn JM, Nam SM, Stulting RD, et al. (2014) Evaluation of dry eye and meibomian gland dysfunction after cataract surgery. *Am J Ophthalmol* 157: 1144-1150.
16. Khanal S, Tomlinson A, Esakowitz L, Bhatt P, Jones D, et al. (2008) Changes in corneal sensitivity and tear physiology after phacoemulsification. *Ophthalmic Physiol Opt* 28: 127-34.
17. Chung YW, Oh TH, Chung SK (2013) The effect of topical cyclosporine 0.05% on dry eye after cataract surgery. *Korean J Ophthalmol* 27: 167-171.
18. Munish Dhawan, Gagandeep Kaur, S.P. Singh (2018) Dry Eye after Phacoemulsification. *DJO* 29:25-30
19. Ram J, Gupta A, Brar GS, Kaushik S, Gupta A (2002) Outcomes of phacoemulsification in patients with dry eye. *J Cataract Refract Surg* 28: 1386-1389.
20. Al-Aqaba MA, Fares U, Suleman H, Lowe J, Dua HS (2010) Architecture and distribution of human corneal nerves. *Br J Ophthalmol* 94: 784-789.
21. Muller LJ, Vrensen GF, Pels L, Cardozo BN, Willekens B (1997) Architecture of human corneal nerves. *Invest Ophthalmol Vis Sci* 38: 985-994.
22. Sitompul R, Sancoyo GS, Hutaaruk JA, Gondhowiardjo TD (2008) Sensitivity change in cornea and tear layer due to incision difference on cataract surgery with either manual small-incision cataract surgery or phacoemulsification. *Cornea* 1: S13-S18.
23. The definition and classification of dry eye disease: report of the definition and classification subcommittee of the International Dry Eye WorkShop (2007). *The Ocul Surf* 5: 75-92.
24. Belmonte C, Acosta MC, Gallar J (2004) Neural basis of sensation in intact and injured corneas. *Exp Eye Res* 78: 513-25.
25. Zabel RW, Mintsoulis G, MacDonald IM, Valberg J, Tuft SJ (1989) Corneal toxic changes after cataract extraction. *Can J Ophthalmol* 24: 311-316.
26. Roberts CW, Elie ER (2007) Dry eye symptoms following cataract surgery. *Insight* 32: 14-21.
27. Wilson WS, Duncan AJ, Jay JL (1975) Effect of benzalkonium chloride on the stability of the precorneal tear film in rabbit and man. *Br J Ophthalmol* 59: 667-669.