

PROFESSIONAL ARTICLES

STRUČNI ČLANCI

Clinical Center of Vojvodina, Eye Clinic, Novi Sad¹
University of Novi Sad, Faculty of Medicine Novi Sad²

Professional article

Stručni članak

UDK 617.711/.713-002 i 617.741-004.1-089-06

<https://doi.org/10.2298/MPNS1904105B>

DRY EYE SYNDROME AND CATARACT SURGERY

SINDROM SUVOG OKA I OPERACIJA KATARAKTE

Stefan BRUNET¹, Vladimir ČANADANOVIĆ^{1,2}, Nikola BABIĆ^{1,2}, Aleksandar MILJKOVIĆ^{1,2},
Sandra JOVANOVIĆ^{1,2} and Sava BARIŠIĆ¹

Summary

Introduction. Dry eye syndrome has become a common problem after ocular surgeries with a significant impact on the quality of life. Many patients, who have undergone cataract surgery, postoperatively developed dry eye symptoms. Dry eye syndrome is one of the risk factors associated with cataract surgery. **Material and Methods.** The prospective study included 80 patients. We recorded the self-reported dry eye symptoms, the values of Schirmer test, tear breakup time, and best corrected visual acuity preoperatively, as well as 7 days and 1 month after the surgery. **Results.** A total of 80 patients were included in the study, 45 (56.2%) females and 35 (43.8%) males. The mean age of patients was 61.5 years (SD $\pm$ 6.2, range 57 - 70 years). The best corrected visual acuity at the time of surgery was 0.4 or less in 70 patients (87.5%). Most patients reported a significant improvement in visual acuity after surgery; 68 (85%) eyes achieved a best corrected visual acuity of 0.5 or higher (median 0.7; range 0.5 - 1.0). The mean tear breaking time in cataract patients before surgery was 12.4 sec, 7 days after the surgery it was 8.2 sec ($p < 0.05$) and 1 month after the surgery 11.1 sec. The majority of patients had mild (47.5%) and moderate (33.75%) Schirmer test values. Dry eye with wetting < 5 mm after 5 minutes was found in 16.2% of patients before cataract surgery; 7 days after the surgery ($p < 0.05$) it was found in 23.75% of patients and one month after surgery 11.1 sec. A foreign body sensation and watery eye were the most reported symptoms before cataract surgery. Seven days after the surgery foreign body sensation was present in 48.75% and watery eyes in 40% of patients. **Conclusion.** Significant increase in dry eye symptoms after cataract surgery was found with increasing age. Self reported dry eye problems are more common in patients with lower Schirmer test and best corrected visual acuity values before cataract surgery. Patients with concomitant dry eye disease require preoperative and postoperative treatment of dry eye to prevent aggravation of the existing symptoms that may affect the visual outcome after cataract surgery.

Key words: Cataract; Dry Eye Syndromes; Cataract Extraction; Risk Factors; Diagnostic Techniques, Ophthalmological; Tears; Signs and Symptoms; Age Factors

Sažetak

Uvod. Sindrom suvog oka je čest problem nakon oftalmoloških operacija sa značajnim uticajem na kvalitet života operisanih. Nakon operativnog lečenja katarakte, kod pacijenata su prisutni simptomi u vezi sa suvim okom. Sindrom suvog oka predstavlja jedan od faktora rizika nakon operacije katarakte.

Materijal i metode. Prospektivna studija je obuhvatila 80 pacijenata. Subjektivni simptomi u vezi sa suvim okom, Šrimerov (Schirmer) test, vreme prekida suznog filma i najbolja korigovana vidna oština evaluirani su preoperativno, sedam dana i jedan mesec nakon operacije. **Rezultati.** Od 80 pacijenata 45 (56,2%) su žene, a prosečna starost 61,5 godina (SD $\pm$ 6,2, raspon 57–70 godina). Preoperativna najbolja korigovana vidna oština iznosila je 0,4 ili manje kod 70 pacijenata (87,5%) a nakon operacije kod 68 (85%) postignuta je 0,5 ili veća (medijana 0,7; raspon 0,5–1). Prosečno vreme prekida suznog filma pre operacije bilo je 12,4 sec, nakon sedam dana 8,2 sec ($p < 0,05$), a mesec dana posle operacije 11,1 sec. Kod 47,5% pacijenata Šrimerov test je iznosio 10–14 i kod 33,75% 5–9 mm/5 min. Suve oči sa vrednostima < 5 mm preoperativno imalo je 16,2% pacijenata a 23,75% sedmog postoperativnog dana ($p < 0,05$). Sedmog postoperativnog dana 48,75% pacijenata imalo je osećaj prisustva stranog tela koji je u 40% praćen pojačanim suzenjem. **Zaključak.** Tokom starenja značajno se povećavaju simptomi suvog oka. Subjektivni simptomi su izraženiji kod pacijenata sa nižim preoperativnim vrednostima Šrimerovog testa i vrednostima vremena prekida suznog filma. U cilju sprečavanja pogoršanja osnovnog oboljenja koje može uticati na ishod operacije katarakte, potreban je adekvatan preoperativni i postoperativni tretman suvog oka.

Ključne reči: katarakta; sindrom suvog oka; ekstrakcija katarakte; faktori rizika; oftalmološke dijagnostičke procedure; suze; znaci i simptomi; faktori starosti

Abbreviations

TBUT	– tear breakup time
BCVA	– best corrected visual acuity
IOL	– intraocular lens
PHACO	– phacoemulsification

Introduction

A healthy ocular surface and a stable tear film are essential to preserve the smooth optical surface of the cornea. Tears are made up of three layers: the lipid layer on the outside, the aqueous layer in the middle, and the inner mucus layer. The three layers together are known as the tear film. The main functions of the tear film are lubrication, nutrition and prevention of conjunctival and corneal infections.

Dry eye syndrome or keratoconjunctivitis sicca is the most common ocular surface disease throughout the world [1]. This autoimmune disorder consists of qualitative and quantitative changes of the tear film. The cause of the tear film dysfunction is the alteration of tear aqueous, mucus and lipid component. It is estimated that 8 – 35% of the population has dry eye syndrome [1, 2].

Dry eye syndrome has a multifactorial origin and main risk factors are female gender, advanced age, and morphological changes in the lacrimal glands. Although the etiologies of dry eye are various, common to all ocular-surface disease is an underlying cytokine/receptor-mediated inflammatory process [3].

The Dry Eye Workshop, in 2007, defined dry eye as a multifactorial disease of tears and ocular surface that results in symptoms of discomfort, visual disturbance and tear film instability with potential damage to the ocular surface, which is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface [4]. The majority of dry eye symptoms (foreign body sensation, ocular fatigue, blurring, photophobia, red eye, feeling of heavy eyelids, epiphora etc.) are due to loss of tear film integrity.

Significant progress in the treatment of dry eye has been made in the last two decades; progressing from lubricating and hydrating the ocular surface with artificial tear to stimulating tear secretion; anti-inflammation and immune regulation [5].

Cataract surgery is a clinically effective and safe surgical procedure, and the risks of sight threatening complications are low. High rate of surgical success has created high expectations of patients regarding the vision outcome and improvement in vision related everyday activities [6, 7].

Dry eye has become a common problem after ophthalmic surgeries with a significant impact on the quality of life. Many patients who have undergone cataract surgery have complained of postoperative dry eye and symptoms of irritation [8, 9].

Dry eye is one of the risks associated with cataract surgery. Cataract surgery has been found to exacerbate pre-existing dry eye and to induce dry eye in patients with healthy corneas. This postoperative dry eye can negatively affect visual outcomes and visual recovery

time [10]. Since the incidence of dry eye and cataract both increase with age, it is not a surprise that four out of five cataract patients may have moderate to severe dry eye symptoms [11].

The aim of this prospective study was to determine the incidence and natural course of dry eye, self-reported dry eye symptoms, and to identify risk factors for development of dry eye after cataract surgery.

Material and Methods

This prospective study included 80 patients with senile cataract who underwent surgery at the Eye Clinic of the Clinical Center of Vojvodina in Novi Sad.

All patients underwent clinical and ophthalmological evaluation before cataract surgery with phacoemulsification (PHACO) and foldable intraocular lens (IOL) implantation (PHACO + IOL) and 7 days and 1 month after the cataract surgery.

We recorded the self-reported dry eye symptoms (foreign body sensation, discomfort, dryness, redness of eye and watery eyes) preoperatively and after the surgery. Tear dynamics were assessed by Schirmer test. After placing a small strip of filter paper inside the inferior fornix, the eyes were closed for 5 minutes. The paper was then removed and the amount of moisture was measured. Both eyes were tested at the same time.

According to Schirmer test values, the patients were divided into 3 groups:

Group A. Mild (10 – 14 mm wetting of the paper after 5 minutes),

Group B. Moderate (5 – 9 mm wetting of the paper after 5 minutes),

Group C. Severe (< 5 mm wetting of the paper after 5 minutes).

To measure the tear breakup time (TBUT), 2% sodium fluorescein was instilled into the patient tear film, and all eyes were examined with a slit lamp under cobalt blue light. The TBUT was recorded as the number of seconds that elapsed between the last blink and the appearance of the first dry spot in the tear film. A TBUT under 10 seconds was considered abnormal.

The values of Schirmer test, TBUT, self-reported dry eye symptoms and visual acuity were evaluated before and after the cataract surgery. Patients with other general health problems (allergy, rheumatoid arthritis, stroke etc.) or any eye conditions accompanied with cataract (pterygium, cornea guttata, glaucoma, diabetic eye disease etc.) or any intraoperative and post-operative complications that may have contributed dry eye symptoms (corneal trauma, vitreous loss, corneal edema, Descemet folds, bullous keratopathy etc.) were not included in the study.

Results

A total of 80 patients were included in this study, 45 (56.2%) females and 35 (43.8%) males. The mean age of patients was 61.5 years (SD $\pm$ 6.2, range 57 – 70 years). According to maturity, an immature cataract was found in 47 (58.75%) eyes, intumescent

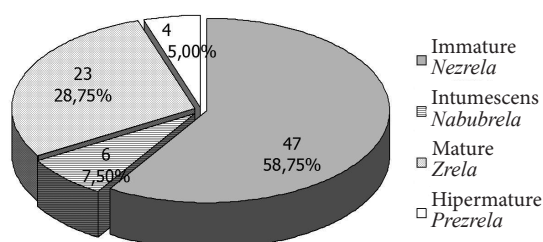


Figure 1. Maturity of cataracts
Slika 1. Zrelost katarakte

cataract in 6 (7.5%), mature cataract in 23 (28.75%), and hypermature in 4 (5%) eyes (**Figure 1**).

At the time of surgery, best corrected visual acuity (BCVA) was 0.4 or lower in 70 (87.5%) patients. A significantly better postoperative BCVA was established in most patients; 68 (85%) eyes achieved a BCVA of 0.5, or better (median 0.7, range 0.5 – 1.0). The remaining 12 (15%) eyes had a BCVA of 0.2, or better (median 0.3, range 0.2 – 0.4). The main preoperative and postoperative BCVA values are shown in **Figure 2**.

The mean TBUT in cataract patients before surgery was 12.4 seconds, 7 days after the surgery 8.2 seconds ($p < 0.05$) and 1 month after the surgery 11.1 seconds. The mean values of TBUT are shown in **Figure 3**.

The majority of patients had mild (47.5%) and moderate (33.75%) Schirmer test values. Dry eye with wetting < 5 mm after 5 minutes were found in 16.2% before cataract surgery, and 23.75% 7 days ($p < 0.05$) and one month after the surgery 21.25%. Schirmer test values in A, B and C groups before and after the surgery are shown in **Table 1**.

Foreign body sensation and watery eye were the most commonly reported symptoms before the

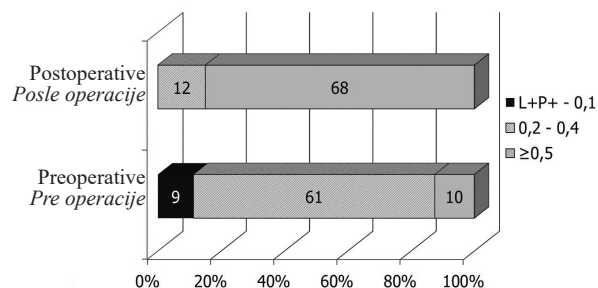


Figure 2. Preoperative and postoperative best corrected visual acuity

Slika 2. Preoperativna i postoperativna najbolja korigovana vidna oštrina

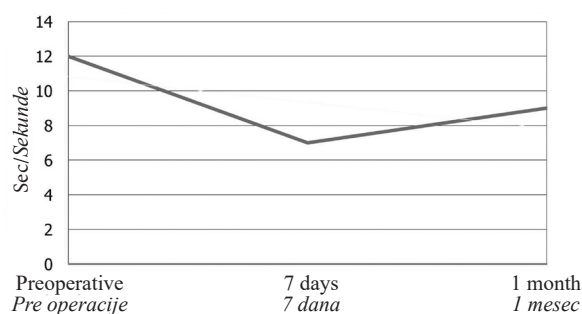


Figure 3. Mean values of the tear breakup time
Slika 3. Srednje vreme prekida suznog filma

cataract surgery. Seven days after the surgery, foreign body sensation was present in 48.75%, and watery eye in 40%. There were more self reported dry eye problems 7 days and 1 month after the surgery. Self reported dry eye symptoms in cataract patients are shown in **Table 2**.

Table 1. Schirmer test values (80 eyes)

Tabela 1. Vrednosti Širmerovog testa (80 očiju)

Schirmer test values Vrednosti Širmerovog testa	Before surgery Pre operacije	7 days after 7 dana posle operacije	1 month after surgery 1 mesec posle operacije
A (10 – 14 mm)	40	35	38
B (5 – 9 mm)	27	26	25
C (< 5 mm)	13	19	17

Table 2. Self reported dry eye symptoms

Tabela 2. Lična procena simptoma suvog oka

Self-reported symptoms Lična procena simptoma suvog oka	Before surgery Pre operacije	7 days after surgery 7 dana posle operacije	1 month after surgery 1 mesec posle operacije
Foreign body sensation Osećaj stranog tela	24	39 ($p < 0.05$)	27
Discomfort/Neprijatnost	12	24 ($p < 0.05$)	21
Dryness/Suvoća	14	21	19
Redness/Crvenilo	6	9	7
Watery eyes/Suzenje oka	20	32 ($p < 0.05$)	23

Discussion

Cataract surgery has become one of the most frequently performed and most successful surgical procedures with positive outcome [12]. Advances in new technology have led to the development of small incision PHACO surgery. These techniques have increased the efficacy of surgery with faster rehabilitation and reintegration in daily life activities.

High rate of surgical success has led to high expectations of patients regarding the vision outcome and improvement in vision related everyday activities [13]. In our study, visual acuity after cataract surgery was improved in the majority of the operated eyes. The largest group achieved good visual results after cataract surgery, 85.2% of operated patients with BCVA > 0.5.

Epitropoulos et al., in the research on the effect of tear osmolarity on repeatability of keratometry for cataract surgery planning, showed that taking care of dry eye syndrome before cataract surgery provides patients not only with more comfortable eyes but also better vision after surgery [14].

The prevalence and risk factors associated with dry eyes were evaluated in many studies. Lee et al., in their population based study, reported most dry eye symptoms in 40–49 year age group (37.6%), and a significant increase in dry eye symptoms was found with increasing age. The prevalence of dry eye was 1.4 times higher in men than in women [15].

In our study, 13/80 (16.2%) cataract patients had severe dry eye evaluated using Schirmer test with values 5 mm or less. The mean age of patients was 61.5 years (SD $\pm$ 6.2, range 57 – 70 years) and 45 (56.2%) were females.

Increased age and dry eye has also been reported in the study of Moss [16] and McCarty [17], although Schein et al. [18] found no age correlation et al.

In our study, the Schirmer test values showed significant changes 7 days after the surgery in the group with severe values before the cataract surgery (group C).

Barabino et al. conducted a study including forty subjects undergoing PHACO for cataract extraction and reported that Schirmer test values did not show any significant changes throughout the study, but statistically significant changes in symptoms, corneal fluorescein staining, lissamine green conjunctival staining, and TBUT occurred at day 1 and 7 after the surgery. This study indicates that cataract surgery may induce a clinical picture similar to dry eye, pointing out possible risks in patients with previous ocular surface diseases [19].

The mean TBUT of patients in our study was 12.4 seconds and 7 days after the surgery 8.2 seconds ($p < 0.05$). There were more self reported problems like foreign body sensation, discomfort, dryness and redness 7 days and 1 month after the surgery.

Self-reported dry eye (discomfort, dryness and watery eyes) up to 6 months after surgery was described to be among the most common complaints after cataract surgery in the study of Recchioni et al. [20].

Many reports of dry eye syndrome have focused on patients who had undergone PHACO and subsequently developed dry eye. Kasetsuwan et al. reported that the incidence of dry eye after PHACO was 9.8%. Symptoms and signs of dry eye occurred as early as seven days post-surgery and the severity pattern improved over time. According to the Schirmer test, 88.89% had a normal test [21].

In our study, 7 days after cataract surgery 26/80 (32.5%) patients had Schirmer test values 5–9 mm (group B) and 19/80 (23.7%) < 5 mm (group C). There were no statistically significant changes in Schirmer test values 1 month after the surgery.

The study of Ishrat et al. concluded that the incidence of dry eye is higher in small incision cataract surgery (SICS) than PHACO due to tear film instability. Dry eyes were found in 42% ($p < 0.001$) of patients at 1 week follow-up. Fifteen percent of eyes were showing symptoms of dry eye at 1 month and 9% at 3 months after surgery. The majority of eyes in their study (27/42, 64.3%) had mild dryness. They also reported the significant differences in TBUT at 1 week, 1 month and 3 months postoperatively [22].

Optimization of the ocular surface before moving the patient to the operating room is essential for achieving the best surgical outcome. An impaired ocular surface has an impact on preoperative planning for cataract surgery [23]. Patients with cataract and concomitant dry eye disease require special consideration in order to prevent impairment of the existing symptoms, as well as being properly informed of the risks of dry eye associated with cataract surgery [24].

While several supportive measures have been developed and clinically applied, effective treatment and prophylaxis of dry eye has not yet been established. Further studies are necessary for a better comprehension of the consequence of cataract surgery on the ocular surface.

Conclusion

Concerning the results of many previous clinical studies and results of our study, cataract surgery with intraocular lens implantation in patients with dry eye syndrome is an effective and safe surgical procedure with good visual outcome. The risk of developing postoperative dry eye problems is related to preoperative qualitative and quantitative tear film status. Patients with concomitant dry eye disease require preoperative and postoperative treatment of dry eye to prevent impairment of symptoms that may affect the visual outcome after the cataract surgery.

References

1. Chia EM, Mitchell P, Rochtchina E, Lee AJ, Maroun R, Wang JJ. Prevalence and associations of dry eye syndrome in an older population: the Blue Mountains Eye Study. *Clin Exp Ophthalmol*. 2003;31(3):229-32.
2. 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.
3. Stern ME, Beuerman RW, Fox RI, Gao J, Mircheff AK, Pflugfelder SC. The pathology of dry eye: the interaction between the ocular surface and lacrimal glands. *Cornea*. 1998;17(6):584-9.
4. Craig JP, Nichols KK, Akpek EK, Caffery B, Dua HS, Joo CK, et al. TFOS DEWS II definition and classification report. *Ocul Surf*. 2017;15(3):276-83.
5. Zhang X, M VJ, Qu Y, He X, Ou S, Bu J, et al. Dry eye management: targeting the ocular surface microenvironment. *Int J Mol Sci*. 2017;18(7):1398.
6. Čanadanović V, Latinović S, Babić N, Miljković S, Grković D, Barišić S. Vision related problems after cataract surgery. *Med Pregl*. 2017;70(9-10):307-11.
7. Erie JC. Rising cataract surgery rates: demand and supply. *Ophthalmology*. 2014;121(1):2-4.
8. Ram J, Gupta A, Brar G, Kaushik S, Gupta A. Outcomes of phacoemulsification in patients with dry eye. *J Cataract Refract Surg*. 2002;28(8):1386-9.
9. Cho YK, Kim MS. Dry eye after cataract surgery and associated intraoperative risk factors. *Korean J Ophthalmol*. 2009;23(2):65-73.
10. Roberts CW, Elie ER. Dry eye symptoms following cataract surgery. *Insight*. 2007;32(1):14-23.
11. Trattler WB. Prevalence of dry eye in surgical populations. *ASCRS Eyeworld CME Supplement*. 2013 Oct;2.
12. Čanadanović V, Babić N, Davidović S, Miljković A, Brunet S, Barišić S. Outcome of cataract surgery in diabetic patients. *Med Pregl*. 2018;71(7-8):217-21.
13. Čanadanović V, Latinović S, Babić N, Babović S, Žikić Z, Lješević Lj, et al. Quality of life in patients with cataract - VQOL study group report. *Patient Reported Outcomes Newsletter*. 2005;34:23-4.
- Rad je primljen 21. III 2019.
- Recenziran 7. IV 2019.
- Prihvaćen za štampu 25. IV 2019.
- BIBLID.0025-8105:(2019):LXXII:3-4:105-109.
14. Epitropoulos AT, Matossian C, Berdy GJ, Malhotra RP, Potvin R. The effect of tear osmolarity on repeatability of keratometry for cataract surgery planning. *J Cataract Refract Surg*. 2015;41(8):1672-7.
15. Lee AJ, Lee J, Saw SM, Gazzard G, Koh D, Widjaja D, et al. Prevalence and risk factors associated with dry eye symptoms: a population based study in Indonesia. *Br J Ophthalmol*. 2002;86(12):1347-51.
16. Moss SE, Klein R, Klein BE. Prevalence of and risk factors for dry eye syndrome. *Arch Ophthalmol*. 2000;118(9):1264-8.
17. McCarty CA, Bansal AK, Livingston PM, Stanislavsky YL, Taylor HR. The epidemiology of dry eye in Melbourne, Australia. *Ophthalmology*. 1998;105(6):1114-9.
18. Schein OD, Tielsch JM, Munoz B, Bandeen-Roche K, West S. Relation between signs and symptoms of dry eye in the elderly. A population-based perspective. *Ophthalmology*. 1997;104(9):1395-401.
19. Barabino S, Solignani F, Rolando M. Dry eye-like symptoms and signs after cataract surgery. *Invest Ophthalmol Vis Sci*. 2010;51(13):6254.
20. Recchioni A, Bhogal G, Aujila M, Wolffsohn JS, Kolli S, Hartwig A, et al. Dry eye signs and symptoms before and after cataract surgery. *Invest Ophthalmol Vis Sci*. 2018;59(9):4888.
21. Kasetsuwan N, Satitpitakul V, Changul T, Jariyakosol S. Incidence and pattern of dry eye after cataract surgery. *PLoS One*. 2013;8(11):e78657.
22. Ishrat S, Nema N, Chandravanshi SCL. Incidence and pattern of dry eye after cataract surgery. *Saudi J Ophthalmol*. 2019;31(1):34-40.
21. Chuang J, Shih KC, Chan TC, Wan KH, Jhanji V, Tong L. Preoperative optimization of ocular surface disease before cataract surgery. *J Cataract Refract Surg*. 2017;43(12):1596-607.
22. Afsharkhamsch N, Movahedan A, Motahari H, Djalilian AR. Cataract surgery in patients with ocular surface disease: an update in clinical diagnosis and treatment. *Saudi J Ophthalmol*. 2014;28(3):164-7.