International Journal of Advances in Medicine
Yuananda AAAS et al. Int J Adv Med. 2025 Jul;12(4):407-412
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20251940

Original Research Article

The relationship between cataract surgery technique and the incidence of dry eye syndrome at Wangaya Regional General Hospital, Denpasar, Bali

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Received: 01 April 2025
Revised: 06 May 2025
Accepted: 07 May 2025

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ABSTRACT

Background: Cataracts are opacities in the natural intraocular lens that focuses light entering the eye onto the retina. These opacities can cause decreased vision and can eventually lead to blindness if left untreated. Modern cataract surgery, which involves removal of the cloudy lens and implantation of a clear intraocular lens (IOL), is the only definitive therapy for cataracts. Starting from Small Incision Cataract Surgery (SICS) techniques that involve cutting the conjunctiva and sclera, to phacoemulsification (PHACO). Some surgical procedures such as cataract surgery are also responsible for causing dry eye syndrome or worsening existing symptoms in dry eye syndrome. Dry eye syndrome affects a person's quality of life, especially when reading, watching, driving and when using a laptop or similar electronic device. Based on the background above, the researcher is interested in conducting a scientific study entitled "The relationship between cataract surgery technique and the incidence of dry eye syndrome at Wangaya Regional General Hospital, Denpasar, Bali".
Methods: This study uses an observational analytical research design using a cross-sectional approach with secondary data collection obtained from medical records at Wangaya Regional General Hospital in 2021-2024. The statistical test employed in this study was the Chi-Square test, with a significant relationship between variables considered if the p-value is less than 0.05. This study enrolled 55 cataract surgery patients.
Results: Of the 55 patients, 38 (69.1%) has dry eye syndrome, amongst the dry eye syndrome patients that had cataract surgery, 21 (55.3%) were 61-70 years old, 21 (55.3%) were male, 34 (89.5%) has non-bachelor level of education, 19 (50.0%) has history of comorbid disease, 29 (76.3%) went through SICS procedure of cataract surgery.
Conclusions: There is a relationship between cataract surgery techniques and the incidence of dry eye syndrome at Wangaya Regional General Hospital, Denpasar, Bali, proven by the results of statistical calculations obtained ρ value=0.016. Commonly the patient that underwent cataract surgery also has dry eye syndrome. Most of the patient that has dry eye syndrome went through SICS procedure of cataract surgery.

Keywords: Cataract surgery, Dry eye syndrome, PHACO, SICS

INTRODUCTION

A cataract is a clouding or opacification of the lens or its capsule (the clear membrane that surrounds the lens), which prevents light from passing through the lens to the retina of the eye.[1] Based on national data from the 2014-2016 rapid assessment of avoidable blindness (RAAB) blindness survey by the ministry of health, targeting the population aged 50 years and over, it is known that the blindness rate has reached 3% and cataracts are the leading cause of blindness (81,3%).[2] Cataract treatment has primarily been surgical, evolving over time. Initially, extra

capsular cataract extraction (ECCE) used corneoscleral incisions, followed by Small Incision Cataract Surgery (SICS), which involved cutting the conjunctiva and sclera. Phacoemulsification (PHACO) later introduced trans corneal incisions with variations in location. These procedures can damage the cornea, conjunctiva and tear film, leading to complications such as dry eye syndrome. Damage to the natural layer of tears that coats the front of the eye, called the tear film, can be called dry eye syndrome (DES).

This disease is caused by many factors (multi-factorial) involving the ocular surface, with characteristics of impaired homeostasis of the tear film accompanied by ocular symptoms due to instability of the tear film, hyperosmolarity, damage and inflammation of the ocular surface and neurosensory abnormalities.[3] Dry eye syndrome is more common in black and Asian races. The largest and most densely populated area in the world is Asia, the prevalence of dry eye syndrome patients from 2007 - 2019 was 3.8 to 64% with an average of 20.1% of individuals in Asian countries suffering from dry eye syndrome. Previous studies have shown that the prevalence of dry eye syndrome in Asian populations is higher than in other ethnicities.[4]

The incidence of dry eye syndrome among patients undergoing cataract surgery has been shown to depend on a number of factors including the type of procedure, the type of ophthalmic solution used, intraoperative medications, concomitant systemic disorders, exposure to the operating microscope light and the cumulative dissipated energy (CDE) used during the procedure and the length of surgery.[5]

Dry eye syndrome is a leading cause of ocular surface disease, with approximately 25% of patients visiting eye clinics reporting symptoms of the condition. This makes dry eye syndrome a growing concern in society and one of the most frequently encountered issues by eye care professionals. Treating dry eye syndrome typically involves high costs and often yields limited results, with many patients experiencing little to no significant improvement in their symptoms.

Based on the background above, this study, titled "The Relationship Between Cataract Surgery Technique and the Incidence of Dry Eye Syndrome at Wangaya Regional General Hospital, Denpasar, Bali," aims to examine the link between patient characteristics and the occurrence of dry eye syndrome after cataract surgery from April 2021 to April 2024.

METHODS

This study is an observational analytical study with a cross-sectional design conducted at Wangaya Regional General Hospital, Denpasar, Bali, Indonesia, covering the period from April 2021 to April 2024. The study utilized secondary data obtained from the hospital's medical records. The inclusion criteria for this study were post-cataract surgery patients (PHACO or SICS) suffering from dry eye syndrome, as well as post-cataract surgery dry eye syndrome patients who received treatment at Wangaya Regional Hospital between April 2021 and April 2024. The population of research are all patients with dry eye syndrome post cataract surgery at Wangaya Regional General Hospital.

The sampling method used in this study was purposive sampling, which involves selecting participants based on specific inclusion and exclusion criteria. The variables in this study were age, gender, education, comorbid disease history, surgical incision technique and whether or not the patient suffered from postoperative dry eye syndrome. No interventions or additional examinations were conducted as part of this study.

This study was approved by the Ethics Committee of Wangaya Regional Hospital, Denpasar, Bali, Indonesia (Ethical Clearance: 112/XI.1 1/KEP/RSW/2024 Date: 12 November 2024). The collected data were analyzed using univariate and bivariate statistical methods to evaluate the distribution of variables and identify potential associations between them.

RESULTS

During April 2021–April 2024, there were 55 patients that undergoes cataract surgery and amongst them, 38 cases (69.1%) are diagnosed with dry eye syndrome at the Wangaya Regional Hospital. The age distribution was divided into four categories, with the highest number of patients in the 61-70 years old group, comprising 21 cases (55.3%). This was followed by the >70 years old group with 11 cases (28.9%), the 51-60 years old group with 6 cases (15.8%) and no cases in the 41-50 years old category. We also found that there were more male patients than female, namely 21 male (55.3%), while 17 are female (44.7%).

Based on the patient's education level, non-bachelor level was found to be more common of patient diagnosed with dry eye syndrome post cataract surgery, which were as many as 34 patients (89.5%), followed by bachelor level, as many as 4 patients (10,5%). There is no significant difference between patients with comorbid diseases and those without, as both groups represent 50.0% of the cases. And lastly, on cataract surgery history, 29 patients (76.3%) have history of undergoing SICS surgery and 9 patients (23,7%) has history of undergoing PHACO surgery.

Among post-cataract surgery patients, 29 individuals (80.6%) who underwent the SICS surgical technique experienced dry eye syndrome, while 9 individuals (47.4%) who underwent the Phacoemulsification technique experienced the condition. This indicates a higher proportion of dry eye syndrome in patients who had the SICS procedure compared to those who had phacoemulsification.

The difference in proportions was found to be statistically significant, with the Chi-Square test yielding a p-value of 0.016 ($p<0.05$), leading to the rejection of the null hypothesis. This suggests a significant relationship between the type of cataract surgery technique and the occurrence of dry eye syndrome in post-cataract surgery patients at Wangaya Hospital.

Table 1: Characteristics of post-cataract surgery patients.

Characteristics	Frequency	%
Age (in years)		
41-50	0	0.0
51-60	8	14.5
61-70	32	58.2
>70	15	27.3
Gender		
Male	33	60.0
Female	22	40.0
Level of education		
Bachelor	6	10.9
Non-bachelor	49	89.1
Comorbid disease history		
Yes	22	40.0
No	33	60.0
Cataract surgery history		
SICS	36	65.5
PHACO	19	34.5
Dry eye syndrome post cataract surgery		
Yes	38	69.1
No	17	30.9

Table 2: Characteristics of patients with dry eye syndrome post cataract surgery.

Characteristic	Frequency	%
Age (years)		
41-50	0	0.0
51-60	6	15.8
61-70	21	55.3
>70	11	28.9
Gender		
Male	21	55.3
Female	17	44.7
Level of education		
Bachelor	4	10.5
Non-bachelor	34	89.5
Comorbid disease history		
Yes	19	50.0
No	19	50.0
Cataract surgery history		
SICS	29	76.3
PHACO	9	23.7

Table 3: Dry eye syndrome patient post cataract surgery distribution based on comorbid disease history.

Comorbid disease	Frequency	%
Diabetes	10	26.3
Hypertension	9	23.7
No comorbid disease	33	50.0

Table 4: The relationship between cataract surgery technique and the incidence of dry eye syndrome.

S. no.	Cataract surgery incision type	Dry eye syndrome				Total		P value
		Yes		No				
		N	%	N	%	N	%	
1.	SICS	29	80.6	7	19.4	36	100	0.016
2.	PHACO	9	47.4	10	52.6	19	100	
	Total	38	69.1	17	30.9	55	100	

DISCUSSION

Dry eye syndrome (DES) is commonly found in cataract patients, as both conditions share similar age-related risk factors. Conducting a preoperative evaluation for DES is crucial for enhancing postoperative results. Pre-existing DES, which impacts the tear film, can potentially affect biometry outcomes. Additionally, special intraoperative care is required for eyes with DSE to minimize complications and improve recovery. DES is frequently observed after cataract surgery and pre-existing DSE may worsen post-surgery. In such cases, even with successful visual outcomes, patient dissatisfaction is often due to persistent DSE symptoms.[6]

In this study, there were 38 patients with post-cataract surgery dry eye syndrome, 29 of whom (76.3%) underwent the SICS procedure and 9 patients (23.7%) underwent the PHACO procedure. This shows that the proportion of post-cataract surgery patients who underwent the SICS cataract surgery technique is higher than that of post-cataract surgery patients who underwent the Phacoemulsification surgery technique. This finding is consistent with research by Kurniasih, which states that the majority of patients with dry eye syndrome underwent the SICS procedure, while fewer patients who underwent the PHACO technique experienced dry eye syndrome. This is because PHACO involves a smaller incision of approximately 2.50-2.75 mm, resulting in less trauma and inflammation, which in turn affects the occurrence of dry eye syndrome differently.[7]

In this study, most patients suffering from postoperative dry eye syndrome were aged 61-70 years (55.3%), which aligns with research by Garg et al, where the majority of patients were over 60 years old. Dry eye conditions are prevalent worldwide, with advancing age being a significant risk factor. The incidence of dry eye in individuals over 60 years old is 26.2%. Age is frequently linked to the development of DES after cataract surgery. Kohli et al demonstrated that individuals over 60 years old had worse OSDI, Schirmer test results, TFBUT, CFS and TMH at 2 weeks post-cataract surgery.[8] This study found that the majority of post-cataract surgery dry eye syndrome (DES) sufferers were men, accounting for 55.3%. This contradicts the common belief that postmenopausal women are at a higher risk of developing DES than men. However, this could be attributed to socio-economic factors. A study conducted across 23 low- to middle-income countries found that men with cataracts are 1.71 times more likely to undergo surgery than women with the same condition. Women are often more likely to avoid surgery due to limited education and economic resources, which may lead many to endure the condition and continue their daily activities despite worsening visual impairment.[9]

Most of the post-cataract surgery dry eye syndrome patients had an education level below a bachelor's degree, which aligns with a study conducted at Bali Mandara Hospital, where the majority of patients with post-cataract surgery DES had an education level below a bachelor's degree or diploma.[10]

In this study, there was no difference in the proportion of patients with and without comorbid diseases. The relationship between post-cataract surgery dry eye syndrome and diabetes mellitus has been reported. Sajnani et al, evaluated the epidemiology of persistent postoperative pain (PPP), which manifests as dry eye syndrome-like symptoms for up to six months after surgery. Autoimmune disorders, non-ocular chronic pain conditions and the use of antihistamines, anti-reflux drugs, antidepressants, anxiolytics and sleep aids have been identified as risk factors for PPP. Hormone replacement therapy, thyroid dysfunction, psychiatric conditions and systemic medications have also been reported as risk factors for post-cataract surgery dry eye syndrome.[6]

The relationship between cataract surgery techniques and the occurrence of dry eye syndrome at Wangaya Hospital showed statistically significant results, with a p-value of 0.016 ($p<0.05$) and a contingency coefficient of 0.323 ($C<0.5$), indicating a weak strength of association in this study. These findings are consistent with research conducted at the Majalengka Eye Clinic in Majalengka Regency in 2021, which also reported a p-value of 0.012 ($p<0.05$). The relationship can be attributed to differences in cataract surgery techniques, specifically small incision cataract surgery (SICS) and Phacoemulsification. SICS involves a larger incision compared to PHACO, leading to greater damage to the conjunctiva and cornea. This increased trauma and inflammation disrupt tear film function and the larger incision may damage stem cells and goblet cells, which play a crucial role in the development of dry eye syndrome. A study conducted at Bali Mandara Hospital in 2019 on the relationship between cataract surgery techniques and the incidence of dry eye syndrome

found significant results, with a p-value of 0.009, indicating a strong association between the surgery techniques and the occurrence of dry eye syndrome in post-cataract surgery patients. This is due to the disruption of the conjunctiva during cataract surgery, which leads to the loss of stem cells and goblet cells, resulting in reduced mucin secretion in the tear film. Additionally, corneal incisions during the surgery decrease corneal sensation, while cutting the ophthalmic branch of the trigeminal nerve reduces tear secretion. Incisions in the peripheral nerves can also impair the blinking reflex, which increases evaporation on the eye's surface and disrupts the tear film formation. Disruption of the corneal nerve plexus plays a significant role in the development of dry eye syndrome.

The results of the study align with the theory that SICS is associated with a higher incidence of dry eye syndrome compared to PHACO, likely due to the larger incision. Similarly, extracapsular cataract extraction (ECCE) leads to more postoperative inflammation than phacoemulsification, which exacerbates and increases the risk of developing dry eye syndrome after cataract surgery.[11] There are some variations across different studies regarding the severity of dry eye syndrome after cataract surgery.

Kasetsuwan conducted a follow-up study on cataract surgery patients at days 0, 7, 30 and 90, finding that the severity of dry eye syndrome peaked on day 7 postoperatively. On the other hand, Dodia's study, which evaluated the incidence of dry eye syndrome on days 1, 7 and 45 after surgery, reported the highest incidence on day 1 postoperatively. However, most studies did not include preoperative assessments to detect dry eye syndrome, making it difficult to determine whether the reported incidence of dry eye was a continuation of pre-existing symptoms or a result of post-cataract surgery effects.[5]

Similarly, a study at the Department of Eye, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem stated that individuals who underwent SICS had a higher prevalence and severity of dry eye syndrome compared to those who underwent PHACO surgery. Other studies have also shown that incision size correlates with the severity and duration of dry eye.[12]

A limitation of this study is the lack of comparison between the incidence of dry eye syndrome before and after cataract surgery, as well as the absence of additional diagnostic tests that could provide more objective and detailed assessments. Future research is recommended to address these gaps by including preoperative evaluations and using standardized diagnostic tools to enhance the accuracy and depth of findings on post-cataract surgery dry eye syndrome.

CONCLUSION

Based on the results of the study and discussion, it can be concluded that there is a relationship between cataract surgery techniques and the incidence of dry eye syndrome at Wangaya Regional General Hospital, Denpasar, Bali. Most of the patients who underwent cataract surgery also experienced dry eye syndrome. Additionally, the incidence of postoperative dry eye syndrome was higher in patients who underwent the SICS procedure compared to those who had the PHACO procedure. For future research, it is recommended to build upon this study and expand the investigation of post-cataract surgery dry eye syndrome by comparing the incidence of dry eye syndrome before and after cataract surgery. Additionally, incorporating supporting diagnostic tests would help obtain more objective and accurate examination results in patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Yuananda AAAS, Dwipayani NM, Wibawa IMDS. The relationship between cataract surgery technique and the incidence of dry eye syndrome at Wangaya Regional General Hospital, Denpasar, Bali. Int J Adv Med 2025;12:407-12.