

Prospective Analysis of the Effect on Tear Film before and after Manual SICS and Phacoemulsification**D.R. Brindha¹, S. Uma Maheswari², M. Gomathi³**¹Senior Resident, Department of Ophthalmology, Government Medical College, Kallakurichi, Tamil Nadu, India²Associate professor, Department of Ophthalmology, Government medical college, Namakkal, Tamil Nadu, India³Assistant Professor, Department of Ophthalmology, Government Medical College, Kallakurichi, Tamil Nadu, India

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Corresponding Author: Dr. D.R. Brindha

Conflict of interest: Nil

Abstract:

Background: Dry eye disease is a multifactorial disorder of the ocular surface and is a common cause of postoperative discomfort following cataract surgery, especially in the elderly population. Symptoms such as foreign body sensation, grittiness, ocular fatigue, and visual disturbance significantly affect the quality of life and patient satisfaction after surgery. Cataract surgery, being the most frequently performed ophthalmic procedure, particularly for senile cataract, can exacerbate pre-existing or subclinical ocular surface disease due to surgical trauma, corneal nerve damage, and postoperative topical medications. Early identification and management of dry eye are therefore essential to improve postoperative outcomes.

Methods: This prospective comparative study included 160 patients undergoing cataract surgery, divided equally into two groups: 80 patients underwent manual Small Incision Cataract Surgery (SICS) and 80 underwent phacoemulsification. Patients were evaluated preoperatively (1 day before surgery) and postoperatively at 7, 30, and 90 days. Dry eye was assessed using the Ocular Surface Disease Index (OSDI) questionnaire, Tear Break-Up Time (TBUT), and Schirmer's test. The incidence and severity of dry eye and ocular surface damage were compared between the two surgical techniques.

Results: A significant increase in dry eye signs and symptoms was observed during the first postoperative week in both groups, evidenced by increased OSDI scores and reduced TBUT and Schirmer's values. OSDI and TBUT showed better correlation with dry eye severity compared to Schirmer's test. By 30 and 90 days postoperatively, tear film parameters gradually improved and returned to near-normal levels. Phacoemulsification was associated with a significantly lower incidence and severity of postoperative dry eye compared to manual SICS.

Conclusion: Dry eye disease is a common but transient postoperative complication following both manual SICS and phacoemulsification. Symptoms are more pronounced in the early postoperative period, likely due to frequent use of topical medications and ocular surface toxicity and resolve as medications are tapered. OSDI and TBUT are more reliable indicators of postoperative dry eye than Schirmer's test. Early postoperative ocular surface evaluation and the use of tear substitutes can reduce epithelial damage and improve patient comfort. Phacoemulsification causes less ocular surface disturbance and offers better postoperative patient well-being.

Keywords: Dry Eye, Manual SICS, Phacoemulsification, Postoperative Period, Tear Film.

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Introduction

Dry eye disease (DED) is a multifactorial disorder of the ocular surface characterized by tear film instability, hyperosmolarity, ocular surface inflammation, and neurosensory abnormalities, resulting in symptoms such as foreign body sensation, grittiness, burning, and visual fluctuation.[1] It is more prevalent in the elderly population and significantly affects the quality of life, making it a critical concern in patients undergoing cataract surgery.[2]

Cataract surgery is the most commonly performed ophthalmic surgical procedure worldwide, particularly for age-related (senile) cataract. Although advances in surgical techniques have led to excellent visual outcomes, postoperative patient satisfaction may be compromised due to ocular surface disturbances and dry eye symptoms.[3] Several studies have reported that cataract surgery can induce or aggravate dry eye disease, even in patients without pre-existing symptoms.[4]

The pathogenesis of postoperative dry eye is multifactorial. Surgical incision-related corneal nerve damage leads to reduced corneal sensitivity and impaired lacrimal functional unit activity, resulting in decreased tear secretion and tear film instability.[5] Additional contributing factors include exposure to operating microscope light, intraoperative irrigation, postoperative inflammation, and toxicity from frequent use of preserved topical medications during the early postoperative period.[6]

Manual small incision cataract surgery (SICS) and phacoemulsification are the two most commonly performed cataract surgeries in developing countries. Manual SICS involves a larger scleral incision and greater ocular surface manipulation compared to phacoemulsification, which uses a smaller corneal incision. Previous studies suggest that manual SICS may be associated with a higher incidence and severity of postoperative dry eye compared to phacoemulsification.[7]

Aims and Objectives: The aim of this study is to evaluate the incidence and severity patterns of dry eye following manual small incision cataract surgery (SICS) and phacoemulsification. The objectives include assessing the incidence and severity of postoperative dry eye, evaluating the extent of ocular surface damage following manual SICS and phacoemulsification, and determining the impact of dry eye on postoperative visual quality and patient-reported visual discomfort.

Materials and Methods

Study Design: This study was a hospital-based prospective observational study conducted in the Department of Ophthalmology at Government Mohan Kumaramangalam Medical College Hospital, Salem, over a period of December 2019 to June 2021. Patients undergoing manual small incision cataract surgery (SICS) and phacoemulsification were recruited for the study after obtaining informed written consent. The study population comprised patients who met the inclusion criteria and were willing to participate, and all procedures were carried out in accordance with institutional ethical guidelines.

Inclusion and Exclusion Criteria: The study included 160 patients aged more than 18 years with uncomplicated cataract who were scheduled to undergo manual small incision cataract surgery or phacoemulsification. Patients who were unwilling to participate were excluded from the study. Additional exclusion criteria included pre-existing dry eye disease, systemic autoimmune disorders such as Sjögren's syndrome and rheumatoid arthritis,

diabetes mellitus, and use on long-term topical ocular medications including those used for glaucoma. Patients with disorders of the eyelids or the nasolacrimal drainage system, previous ocular surgeries, pterygium, and ocular allergies were also excluded to eliminate confounding factors affecting the ocular surface and tear film.

Data Collection Procedure: After obtaining informed written consent, all patients included in the study underwent a comprehensive ophthalmological evaluation. Preoperative assessment included visual acuity testing using the Snellen chart, random blood sugar estimation, blood pressure measurement, anterior segment examination, dilated fundus examination, intraocular pressure measurement, sac syringing, Schirmer's test, and tear film break-up time (TBUT). Based on the surgical technique, patients were divided into two groups: Group A underwent manual small incision cataract surgery (SICS), and Group B underwent phacoemulsification. Ocular surface evaluation using the Ocular Surface Disease Index (OSDI) questionnaire, TBUT, and Schirmer's test was performed one day prior to surgery and postoperatively on days 7, 30, and 90.

All surgeries were performed by two surgeons under regional anesthesia with 2% lignocaine hydrochloride after pupillary dilation using tropicamide (0.8%) and phenylephrine hydrochloride (10%), following strict sterile precautions. Manual SICS was performed using a 7–8 mm tri-planar sclero-corneal incision with implantation of a rigid intraocular lens, while phacoemulsification was performed through a 2.75-mm temporal clear corneal incision with implantation of a foldable intraocular lens. The duration of both procedures ranged from 8 to 12 minutes, and no intraoperative complications were observed. Postoperatively, all patients received antibiotic and steroid eye drops for 45 days in a tapering dose. Dry eye severity was analyzed using mean OSDI scores, average TBUT values, and Schirmer I test results, with TBUT grading and the National Eye Institute criteria used to classify the severity of dry eye.

Statistical Analysis: Data were collected and entered into Microsoft Excel and subsequently analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 23. Descriptive statistics were expressed as frequencies and percentages. Categorical variables were analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Age distribution of study participants

Group	Mean Age (years)	Standard Deviation
Manual SICS	63.29	10.24
Phacoemulsification	62.09	8.99

Table 1 illustrates the age distribution of patients in both surgical groups. The mean age was comparable

between manual SICS and phacoemulsification groups, indicating appropriate age matching.

Table 2: Gender distribution of participants

Gender	Manual SICS	Phacoemulsification	Total
Male	40	29	69
Female	40	51	91
Total	80	80	160

Table 2 shows the gender distribution of study participants. Females constituted a higher proportion

overall, with comparable gender distribution between the two groups.

Table 3: Distribution of cataract diagnosis

Diagnosis	Manual SICS	Phacoemulsification
Left eye immature cataract	22	26
Left eye mature cataract	16	13
Right eye immature cataract	28	29
Right eye mature cataract	13	9
Right eye hypermature cataract	1	1
Right eye PSC	0	2

Table 3 presents the preoperative cataract diagnosis among participants. Both groups were comparable with respect to type and laterality of cataract.

Table 4: Comparison of OSDI scores

Time Point	Manual SICS (Mean)	Phaco (Mean)	p value
Pre-op	14.57	14.92	>0.05
Day 7	29.41	27.76	<0.05
Day 30	18.51	18.23	>0.05
Day 90	16.53	16.49	>0.05

Table 4 illustrates changes in OSDI scores over time. A significant increase in dry eye symptoms was observed at day 7, more pronounced in the

manual SICS group, with gradual recovery by day 90.

Table 5: Comparison of Tear Film Break-Up Time (TBUT)

Time Point	Manual SICS (sec)	Phaco (sec)	p value
Pre-op	24.33	25.99	>0.05
Day 7	11.41	13.84	<0.05
Day 30	15.01	19.61	<0.05
Day 90	17.46	22.66	<0.05

Table 5 demonstrates a significant reduction in TBUT postoperatively in both groups.

Phacoemulsification consistently showed better tear film stability compared to manual SICS.

Table 6: Comparison of Schirmer’s test values

Time Point	Manual SICS (mm)	Phaco (mm)	p value
Pre-op	26.30	25.84	>0.05
Day 7	12.83	16.74	<0.001
Day 30	15.75	21.76	<0.001
Day 90	18.88	24.41	<0.001

Table 6 shows postoperative reduction in Schirmer’s test values, more marked in the manual SICS group. Tear secretion improved over time, with phacoemulsification demonstrating better recovery.

Table 7: Severity of dry eye (OSDI, TBUT, Schirmer's)

Test	Time	Manual SICS	Phacoemulsification
OSDI	Day 7	Moderate–Severe	Moderate
TBUT	Day 7	Mild–Severe	Predominantly Mild
Schirmer	Day 7	Mild–Moderate	Predominantly Mild
All tests	Day 90	Mostly Mild	Mostly Normal

Table 7 summarizes the severity pattern of dry eye across all diagnostic tests. Severe dry eye was more frequent following manual SICS, while phacoemulsification showed milder and faster recovery patterns

Discussion

The present prospective observational study demonstrates that dry eye disease (DED) is a common postoperative finding following cataract surgery, with a higher prevalence and severity observed after manual small incision cataract surgery (SICS) compared to phacoemulsification. The mean age of patients in the manual SICS and phacoemulsification groups was 63 and 62 years respectively, which is comparable to the findings reported by Ishrat et al., who also documented a similar mean age distribution in post-cataract dry eye patients.[8] A female predominance (56.9%) was noted in this study, consistent with previous studies by Ishrat et al.[8] and Kasetsuwan et al.[9] and was likely attributable to postmenopausal hormonal changes affecting tear film stability.

Assessment using the Ocular Surface Disease Index (OSDI) revealed a significant increase in dry eye symptoms in both groups during the early postoperative period, particularly on day 7. In the manual SICS group, mean OSDI scores at days 7, 30, and 90 were 29.4, 18.5, and 16.5 respectively, while corresponding values in the phacoemulsification group were 27.7, 18.2, and 16.48. These findings indicate moderate dry eye in the immediate postoperative period with gradual improvement toward near-normal values by 90 days. Similar trends were reported by Ishrat et al. [8] Kasetsuwan et al. [9] and Sitompul et al. [10] who observed peak symptom severity during the first postoperative week followed by recovery within weeks to months.

Tear film break-up time (TBUT) showed a significant reduction in the early postoperative period in both surgical groups, with consistently lower values in the manual SICS group. TBUT reduction at one week and gradual improvement at one and three months postoperatively observed in this study aligns with reports by Ishrat et al. [8] Oh et al. [11] and Kasetsuwan et al. [9] The longer TBUT observed in the phacoemulsification group may be attributed to a smaller incision size and reduced corneal nerve disruption.

Schirmer's test values also demonstrated a significant reduction in the immediate postoperative period, particularly in the manual SICS group, with gradual normalization by 90 days. These findings are consistent with earlier studies showing transient aqueous tear deficiency following cataract surgery. [8,9,11] However, compared to OSDI and TBUT, Schirmer's test detected fewer cases of dry eye, supporting previous observations that symptom-based questionnaires and tear stability tests correlate better with postoperative dry eye than tear secretion tests alone.[12]

Overall, this study confirms that postoperative dry eye is a transient but clinically significant condition following cataract surgery, more pronounced after manual SICS than phacoemulsification. Factors such as corneal nerve transection, intraoperative ocular surface exposure, microscope light toxicity, and postoperative topical medications likely contribute to tear film instability. [1,13,14] The findings underscore the importance of early postoperative ocular surface evaluation and judicious use of topical medications to minimize patient discomfort and enhance visual rehabilitation.

Limitations

Schirmer's test II which measures the basal secretion of tears was not performed in this study.

Conclusion

Dry eye disease is a common postoperative finding following both manual small incision cataract surgery and phacoemulsification, though it is largely transient, with ocular surface stability returning by 90 days. The early postoperative increase in dry eye symptoms is likely due to ocular surface toxicity from frequent topical medications, which improves as these drugs are tapered. OSDI and tear film break-up time correlated better with dry eye symptoms than Schirmer's test. Phacoemulsification resulted in less ocular surface disturbance and better patient comfort. Early postoperative ocular surface evaluation and timely use of tear substitutes can help minimize epithelial damage and improve postoperative outcomes.

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