Phacoemulsification vs. Manual SICS: Which Poses a Higher Risk for Postoperative Dry Eye?

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Abstract: Aim: The purpose of this study was to investigate the incidence of dry eye development following cataract surgery and analyze whether phacoemulsification and SICS differ in their impact on postoperative dry eye. Methods: Eligible participants were aged 40–80 years, scheduled for cataract surgery, and had no ocular surface abnormalities with normal Schirmer's test values at baseline. Postoperative follow-ups were conducted at 1 and 3 months, with Schirmer's test done to evaluate dry eye development. Dry eye incidence was evaluated by comparing pre- and postoperative measurements. Results: In this study of 101 cataract surgery patients, the overall rate of postoperative dry eye at 3 months was 11.88% (95% CI: 17.94–26.17). Among affected cases, severity grading showed mild dry eye in 25%, moderate in 66.67%, and severe in 8.13%. Small incision cataract surgery (SICS) was associated with a higher incidence of dry eye compared to phacoemulsification. Conclusion: Compared to phacoemulsification, the study discovered a higher frequency of dry eye after SICS. Ophthalmologists must actively screen for dry eye after cataract surgery, as it can develop even in eyes with no prior pathology.

Keywords: dry eye, Small Incision cataract Surgery, phacoemulsification, post cataract surgery, Schirmers test

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I. INTRODUCTION

Dry eye syndrome is a complex ocular condition resulting from impaired tear film function and ocular surface disruption. Patients typically experience eye irritation, variable visual clarity, unstable tear production, and occasionally detectable damage to the eye's surface tissues. [1,2,3] While cataract surgery typically yields excellent visual outcomes, studies indicate that postoperative dry eye may compromise these results. [4,5,6] The pathogenesis of dry eye following cataract surgery is thought to involve surgical trauma-induced ocular surface alterations and postoperative inflammation. At the same time cataract surgery is the most effective and rewarding surgery in the field of ophthalmology.

Cataract remains the leading global cause of blindness, yet its surgical treatment is among the most successful interventions in ophthalmology. Despite the high prevalence of cataract surgery, large-scale studies on postoperative dry eye remain limited, and its symptomatic burden is underreported.[7] Many patients experience irritation, redness, foreign body sensation, and blurred vision postoperatively symptoms often dismissed as transient side effects. These manifestations are particularly pronounced in elderly patients and may progress to chronic dry eye syndrome requiring therapeutic intervention. Traditional extracapsular cataract surgery (ECCE) with large limbal incisions can induce corneal denervation, leading to hypoesthesia and subsequent complications. Prolonged use of postoperative topical steroids and antibiotics, combined with sutures, exacerbates dry eye symptoms. In contrast, phacoemulsification involves smaller incisions, shorter surgical duration, and reduced inflammation, potentially mitigating these risks.[8]

Despite achieving optimal surgical outcomes and Snellen visual acuity, patient satisfaction may be diminished by persistent dry eye symptoms. Given its impact on functional recovery, understanding the incidence and risk factors of postoperative dry eye is crucial.[9] The aim of this study is to evaluate the incidence of postoperative dry eye following cataract surgery and analyze differences between phacoemulsification and small-incision cataract surgery (SICS) techniques.

II. MATERIALS AND METHODS

This prospective observational study was conducted at a tertiary care center from January to May 2024 after obtaining institutional ethics committee approval. Participants were recruited from patients presenting with visually significant cataracts to our ophthalmology outpatient department.

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- Inclusion criteria comprised patients aged 40-80 years scheduled for cataract surgery.
- > Exclusion criteria included:
- Pre-existing dry eye (Schirmer's test <10 mm)
- Systemic conditions affecting tear production (e.g., Sjögren's syndrome)
- Ocular comorbidities (glaucoma, uveitis, lid abnormalities, nasolacrimal duct obstruction)
- Ocular allergies
- Pterygium
- Previous ocular surgeries

The primary outcome measure was dry eye incidence assessed by Schirmer's test (without anesthesia) at 5 minutes. Testing was performed preoperatively and at 1- and 3-month postoperative intervals in the operated eye. Dry eye was defined as Schirmer's value <10 mm and graded as:

- Mild (7-9 mm)
- Moderate (5-7 mm)
- Severe (<5 mm).[11]

Demographic data (age, gender) and surgical technique (phacoemulsification vs. SICS) were recorded for all participants. Follow-up assessments occurred at 1 and 3 months postoperatively. Statistical analysis was performed using SPSS software.

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III. RESULTS

The study cohort was drawn from the Pondicherry district, a region where agriculture serves as the primary occupation. Demographic analysis revealed that the majority (86.1%) of patients undergoing cataract surgery were aged >50 years. This is consistent with the general trend that cataracts are more common in older individuals. (table 1)

Gender wise distribution showed that study included 43.56% males and 56.44% females. Among the 101 patients included in the study, there was a slightly higher proportion of females compared to males. (table 2)

Out of the total 101 patients, 18 patients underwent phacoemulsification, while 83 patients underwent Small Incision Cataract Surgery (SICS). (table 3)

Dry eye symptoms were reported in a significant portion of patients after cataract surgery 13.8% of patients were found to have dry eyes at 1 month after surgery. By 3 months, this number decreased to 11.88%, indicating that some patients' dry eye symptoms improved over time. Majority of patients had mild dry eyes in 1 month. (table 4)

Key Baseline Features of the Study Population are Presented Here.

Table 1: Age Distribution

Age Distribution	Percent
<50 years	13.9 %
>50 years	86.1 %
Total	100 %

Table 2: Gender Distribution

Gender Distribution	Percent
Male	43.6 %
Female	56.44 %
Total	100 %

Table 3: Type of Surgery

Type of Surgery	Percent
Phacoemulsification	17.8 %
SICS	82.2 %
Total	100 %

Table 4: Post Cataract surgery incidence and severity of dry eyes at 1 month and 3 months

N = 101		At 1 Month (%)	At 3 Months (%)
Incidence of dry eye		13.86 %	11.88 %
Distribution as per severity	Mild	85.72 %	25%
	Moderate	7.14 %	66.67 %
	Severe	7.14 %	8.13 %

Table 5: Dry eye incidence post cataract surgery at 3 months

	No of patients	Percentage
SICS	11	91.66 %
Phacoemulsification	1	8.34 %
Total	12	100 %



Graph 1: Graph showing Incidence of Dry Eyes at 1 Month and at 3 Months

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The Schirmer's test values ranged from 3 mm (minimum) to 35 mm (maximum). No statistically significant gender-based differences were observed in postoperative dry eye incidence. However, small incision cataract surgery (SICS) demonstrated a significantly higher rate of dry eye development compared to phacoemulsification. (table 5) Among the 101 study participants, dry eye was identified in 12 cases, while 89 patients maintained normal tear production postoperatively.

IV. DISCUSSION

This investigation was conducted to determine the incidence of postoperative dry eye following cataract surgery, corroborating existing literature while identifying notable distinctions from comparable studies. Our study most cases primarily underwent small incision cataract surgery (SICS), with phacoemulsification representing a smaller subset. A direct comparative analysis of dry eye incidence between these two surgical techniques was performed, revealing significant differences.

In our study, there was no significant gender-based differences in postoperative dry eye incidence. Similar results found to be in Saba Ishrat et al, reported no significant gender-based difference. [10]

In our study the incidence distribution as per severity shows 85.72% had mild,7.14% had moderate, 7.14% had severe dry eye at the end of one month. At the end of 3 month, 25% had mild, 66.67% had moderate, 8.13% had severe dry eyes. The overall incidence of our study shows 13.86% at one month and 11.8% at third month. Abhinav K et al. found similar results, of incidence 22.1% at the end of 3 months. [11]

In our study there was a significant difference between Phacoemulsification and SICS, with SICS showing a much higher incidence 91.66 %, and phacoemulsification 8.34%. In study by Saba Ishrat et al, revealed a significantly greater dry eye prevalence following SICS (53.1%) versus phacoemulsification (22.2%) at one-week follow-up. [10]

In our study, there is high incidence of post op dry eye in manual small incision cataract surgeries with corneoscleral tunnel incisions (91.66 %) than phacoemulsification (8.34%). Similar to Abhinav K et al., a higher incidence was seen in SICS as compared to phacoemulsification.[11]

In our study the association of SICS with dry eye is found to be high 91.66 % than with phacoemulsification 8.34%. Kavitha et al. reported a 66.2% incidence of dry eye following manual small-incision cataract surgery (MSICS) with corneoscleral tunnel incisions, substantially higher than our findings. This discrepancy may be attributed to several factors: (1) the prolonged surgical duration in MSICS, (2) extended operating microscope light exposure, and (3) slower visual recovery necessitating prolonged topical medication use. The larger corneal incision in SICS induces greater corneal nerve damage, disrupting tear film stability and predisposing to dry eye development.[12] Kasetsuwan et al. reported a 9.8% incidence of dry eye following phacoemulsification procedures in their study cohort.[13]

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Phacoemulsification is currently the preferred method for cataract surgery due to its efficiency, safety, and excellent visual results. However, like other corneal procedures, it can lead to post-operative disturbances in the ocular surface and tear film function. 14] Studies indicate that the occurrence of ry eye syndrome after cataract surgery depends on several factors, such as the surgical technique, the type of eye drops used, medications administered during surgery, underlying systemic conditions, exposure to the microscope light, the amount of energy applied during phacoemulsification (cumulative dissipated energy, CDE), and the duration since the operation[15,16,17]

V. LIMITATIONS

There are some limitations in this study.

- There is no equal distribution between SICS and phacoemulsification.
- The surgeries were conducted by different surgeons, leading to variations in operative time. However, the all the instruments and technique used were identical.
- Sensitivity of the corneal was not assessed.

VI. CONCLUSION

Cataract surgery, particularly manual small incision cataract surgery (SICS), is more likely to induce dry eye postoperatively compared to phacoemulsification.

Before undergoing cataract surgery (whether phacoemulsification or SICS), a thorough dry eye assessment by an ophthalmologist is crucial. This helps prevent worsening of ocular surface issues, allows timely treatment, and ensures better visual results.

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