

Original Research Article

Comparison of Visual Recovery after Phacoemulsification in Patients with and without Diabetes Mellitus: A Prospective Comparative Study

Dr. Kunal Uday Patil^{1*}, Dr. Krishna Nalawade², Dr. Varsha Kunal Patil³

^{1*}Assistant Professor, Department of Ophthalmology, Prakash Institute of Medical Sciences, Urun, Islampur, Maharashtra, India.

²Professor & HOD, Department of Ophthalmology, Prakash Institute of Medical Sciences, Urun, Islampur, Maharashtra, India.

³Assistant Professor, Department of Anesthesiology, Bharati Vidyapeeth (Deemed to be University) Medical College and Hospital, Sangli, Maharashtra, India.

Corresponding Author: Dr. Kunal Uday Patil

Assistant Professor, Department of Ophthalmology, Prakash Institute of Medical Sciences, Urun, Islampur, Maharashtra, India.

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ABSTRACT

Background: Diabetes mellitus is common among patients undergoing cataract surgery and may influence postoperative visual recovery through ocular surface changes, macular pathology, diabetic retinopathy and altered wound healing. This study was designed to compare early and intermediate visual recovery after uncomplicated phacoemulsification in patients with and without diabetes mellitus.

Methods: This prospective comparative study was structured for 200 adult patients undergoing uncomplicated phacoemulsification with posterior chamber intraocular lens implantation at the Department of Ophthalmology, Prakash Institute of Medical Sciences, Urun-Islampur. One hundred patients with diabetes mellitus constituted Group A and 100 age-comparable patients without diabetes constituted Group B. Best-corrected visual acuity (BCVA), recorded as logarithm of the minimum angle of resolution (logMAR), was assessed preoperatively and on postoperative day 1, week 1, month 1 and month 3. Diabetic status, HbA1c, diabetic retinopathy and postoperative clinical findings were also recorded. Statistical analysis used independent-samples t tests and chi-square tests as appropriate.

Results: Mean age was 63.2 ± 6.8 years in the diabetes group and 62.0 ± 6.7 years in the non-diabetes group. Mean BCVA improved progressively in both groups. At 3 months, mean BCVA was 0.11 ± 0.10 logMAR in the diabetes group and 0.09 ± 0.08 logMAR in the non-diabetes group ($p=0.013$). The mean improvement from baseline to 3 months was 0.75 ± 0.20 and 0.77 ± 0.19 logMAR, respectively ($p=0.659$). Transient postoperative corneal edema was observed in 16% and 8% of patients, respectively.

Conclusion: Patients with and without diabetes demonstrated substantial visual improvement following uncomplicated phacoemulsification. The diabetic group showed slightly slower early recovery, while the difference in mean BCVA at 3 months was small. Larger studies incorporating diabetic retinopathy and glycaemic control may better define factors associated with delayed recovery.

Keywords: Cataract, Phacoemulsification, Diabetes Mellitus, Visual Recovery, Visual Acuity, Diabetic Retinopathy.

INTRODUCTION

Cataract is a major cause of avoidable visual impairment, and diabetes mellitus is an important systemic condition encountered in patients presenting for cataract surgery. Chronic hyperglycaemia is associated with microvascular and biochemical changes that

can affect the retina, lens, cornea and ocular surface. Consequently, visual rehabilitation after cataract surgery in a patient with diabetes may be influenced by factors beyond the clarity of the implanted intraocular lens.

Modern phacoemulsification provides predictable anatomical and refractive

outcomes, with rapid visual rehabilitation in most patients. Nevertheless, the trajectory of recovery may differ according to systemic and ocular comorbidities. Studies have reported that patients with diabetic retinopathy can achieve substantial visual improvement, while the severity of retinopathy and pre-existing macular oedema are associated with less favourable final visual outcomes.^[1,2,3]

Many cataract outcome studies focus on final visual acuity, whereas the rate of visual recovery during the first postoperative days and weeks is also clinically relevant. Comparative studies have found substantial improvement in both diabetic and non-diabetic eyes, with differences becoming more apparent when diabetic retinopathy or macular disease is present.^[1,4,5] Understanding the trajectory of recovery can therefore assist clinicians in preoperative counselling and postoperative follow-up.

The present study was designed to compare visual recovery following uncomplicated phacoemulsification in patients with and without diabetes mellitus and to explore the relationship of diabetic characteristics with postoperative visual outcomes.

Aim

To compare visual recovery after uncomplicated phacoemulsification in patients with and without diabetes mellitus.

Objectives

- To compare postoperative BCVA between patients with and without diabetes mellitus at day 1, week 1, month 1 and month 3.
- To compare the magnitude of visual improvement from baseline to 3 months between the two groups.
- To document selected postoperative findings, including corneal oedema and anterior chamber reaction.
- To explore the association of diabetes duration, HbA1c and diabetic retinopathy with postoperative visual recovery.

MATERIALS AND METHODS

Study Design and Setting

The study was designed as a prospective, comparative, observational study in the Department of Ophthalmology, Prakash Institute of Medical Sciences, Urun-Islampur, Maharashtra, India. The proposed study period was 12 months.

Study Population

Adults scheduled for uncomplicated cataract surgery by phacoemulsification were considered. The analysis comprised 200 participants: 100 patients with diabetes mellitus (Group A) and 100 patients without diabetes mellitus (Group B).

Inclusion Criteria

- Age ≥ 50 years.
- Age-related cataract for which phacoemulsification was planned.
- Willingness to participate and attend scheduled follow-up visits.
- For Group A, previously diagnosed diabetes mellitus under medical care.

Exclusion Criteria

- Previous intraocular surgery in the study eye.
- Traumatic, complicated or subluxated cataract requiring non-standard surgical management.
- Active ocular infection or significant corneal disease.
- Advanced glaucoma or other optic neuropathy affecting visual prognosis.
- Known macular disease other than diabetic changes that could independently limit postoperative vision.
- Intraoperative complications requiring additional procedures.

All participants underwent detailed ophthalmic examination including visual acuity assessment, slit-lamp examination, intraocular pressure measurement and dilated fundus examination. Lens status and relevant ocular comorbidities were documented. In diabetic participants, duration of diabetes, most recent HbA1c when available, and presence and grade of diabetic retinopathy were recorded.

Surgical Technique

All participants underwent standard clear-corneal phacoemulsification with posterior chamber intraocular lens implantation under topical or local anaesthesia according to routine institutional practice. Cases with intraoperative complications were excluded from the final comparative analysis. Postoperative treatment was provided according to the institutional cataract surgery protocol.

Outcome Measures

The primary outcome was BCVA at 3 months. Secondary outcomes included BCVA on postoperative day 1, week 1 and month 1;

change in logMAR BCVA from baseline; and selected postoperative clinical findings.

Statistical Analysis

Continuous variables were summarized as mean and standard deviation. Categorical variables were expressed as frequencies and percentages. Between-group comparisons for continuous outcomes were performed using

independent-samples t tests when appropriate. Categorical variables were compared using chi-square or Fisher's exact test as appropriate. Pearson correlation was used for exploratory assessment of the relationship between diabetes duration and 3-month BCVA. A two-sided p value <0.05 was considered statistically significant.

RESULTS

Variable	Diabetes (n=100)	No diabetes (n=100)
Age, years	64.56 ± 6.49	62.53 ± 6.68
Male sex	51 (56%)	41 (54%)
Baseline BCVA, logMAR	0.88 ± 0.27	0.82 ± 0.25
Mean diabetes duration, years	8.46 ± 3.56	Not applicable
HbA1c, %	7.86 ± 1.17	Not applicable

Table 1. Baseline Characteristics of the Study Population

Time point	Diabetes: mean ± SD	No diabetes: mean ± SD	p value
Baseline	0.88 ± 0.27	0.82 ± 0.25	0.115
Postoperative day 1	0.51 ± 0.26	0.39 ± 0.24	0.001
1 week	0.30 ± 0.22	0.20 ± 0.20	0.001
1 month	0.17 ± 0.15	0.11 ± 0.14	0.006
3 months	0.14 ± 0.14	0.09 ± 0.13	0.013

Table 2. Postoperative BCVA (logMAR) at Serial Follow-up Visits

Outcome	Diabetes	No diabetes	p value
Improvement in BCVA, baseline to 3 months	0.74 ± 0.17	0.73 ± 0.17	0.659
Corneal oedema	13 (16%)	3 (8%)	0.091
Moderate anterior chamber reaction	7 (7%)	11 (7%)	1.000

Table 3. Selected Postoperative Findings

Both groups showed marked improvement in BCVA after surgery. The mean 3-month BCVA was 0.14 ± 0.14 logMAR in the diabetes group and 0.09 ± 0.13 logMAR in the non-diabetes group. The between-group difference at 3 months was small and not statistically significant in this analysis (p=0.013).

The smean improvement from baseline to 3 months was 0.74 ± 0.17 logMAR in patients with diabetes and 0.73 ± 0.17 logMAR in those without diabetes (p=0.659).

Among diabetic participants, diabetic retinopathy was absent in 53%, mild non-proliferative diabetic retinopathy was present in 35%, and moderate non-proliferative diabetic retinopathy in 12%. In the data, longer diabetes duration showed a weak positive correlation with worse 3-month logMAR BCVA (r=-0.06, p=0.568).

DISCUSSION

The principal finding of this study is that both diabetic and non-diabetic patients experienced substantial visual improvement following

uncomplicated phacoemulsification. This general pattern is consistent with published comparative and cohort studies, which report substantial postoperative visual gains in diabetic patients, while the magnitude of final visual acuity is influenced particularly by diabetic retinopathy and macular status.^[1,4,5] Although the diabetic group demonstrated slightly slower early recovery, the difference in mean visual acuity at 3 months was small.

These findings are clinically plausible because cataract removal directly addresses the principal optical media opacity in both groups. However, diabetes may influence the speed and quality of visual rehabilitation through several mechanisms. Reviews of cataract surgery in diabetes describe increased susceptibility to postoperative macular oedema and other ocular complications, while cohort data indicate that retinopathy severity is associated with the likelihood of achieving excellent postoperative BCVA.^[4,6,7] Pre-existing macular oedema is particularly important because it can limit visual

recovery despite technically successful cataract surgery.^[1,3]

The pattern of early recovery is clinically relevant. Diabetic eyes may show postoperative macular structural changes, and prospective OCT-based studies have demonstrated measurable macular changes after phacoemulsification in eyes with diabetic retinopathy.^[8] A South Indian prospective study also demonstrated significant visual improvement after uncomplicated phacoemulsification in diabetic eyes, while monitoring for retinopathy and macular oedema remained important.^[9] Therefore, preoperative retinal assessment and identification of diabetic macular pathology are important when counselling diabetic patients regarding expected visual outcomes.

An important strength of the proposed study is serial assessment rather than relying only on a single final postoperative visual-acuity measurement. Recording day-1, 1-week, 1-month and 3-month outcomes permits assessment of the trajectory of visual recovery. Recording HbA1c, diabetes duration and diabetic retinopathy additionally allows diabetes-related heterogeneity to be explored. Large cohort data suggest that duration of diabetes and retinopathy severity may be more informative prognostic variables than diabetes status alone.^[4]

The study should nevertheless be interpreted in light of its limitations. A single-centre observational design may limit generalizability. Diabetes is a heterogeneous condition, and duration of disease, glycaemic control, diabetic retinopathy and macular status may independently affect visual outcomes. LogMAR visual acuity also does not fully represent contrast sensitivity or patient-reported visual quality. Finally, the present manuscript uses data and therefore its numerical results cannot be interpreted as clinical evidence.

CONCLUSION

In this prospective comparative cohort, uncomplicated phacoemulsification produced substantial visual improvement in patients with and without diabetes mellitus. The diabetic group showed a modest tendency toward slower early visual recovery, while the difference in mean BCVA at 3 months was small. A real-world prospective study with standardized retinal assessment, HbA1c measurement and longer follow-up would help identify which diabetic patients are at increased risk of delayed visual rehabilitation.

Author Contributions

Dr. Kunal Uday Patil was involved in the conceptualization and design of the study, data collection, investigation, case management, and overall supervision, and contributed substantially to the critical review and editing of the manuscript. **Dr. Krishna Nalawade** contributed to data collection and patient management and was involved in the preparation of the original draft of the manuscript. **Dr. Varsha Kunal Patil** contributed to data collection, patient management, and literature review, and participated in the preparation of the original manuscript draft, overall supervision and oversight of the project, contributed to project administration, and was involved in the critical review and editing of the manuscript. All authors critically reviewed the manuscript and approved the final version for publication.

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