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Research Article

Visual Outcome Following Phacoemulsification with Intraocular Lens Implantation in Age-related Cataract

Dewan Fazle Ghani[1, *], Arif Hayat Khan Pathan[2], Fakhrul Islam[1], Rafia Islam Jui[3]

[1]Department of Ophthalmology, Zainul Haque Sikder Women's Medical College & Hospital (Pvt.) Ltd. Dhanmondi, Dhaka, Bangladesh

[2]Department of Ophthalmology, Ad-Din Women's Medical College, Dhaka, Bangladesh

[3]Department of Ophthalmology, Ispahani Islamia Eye Institute, Dhaka, Bangladesh

Abstract

Background: Age-related cataract is the leading cause of reversible blindness worldwide. Phacoemulsification with intraocular lens (IOL) implantation is the standard surgical treatment, offering rapid visual recovery and minimal complications. Objective: To evaluate the visual outcomes following phacoemulsification with intraocular lens implantation in patients with age-related cataract. Methods: This descriptive observational study included 250 patients undergoing cataract surgery. Pre-operative assessment included visual acuity, slit lamp examination, intraocular pressure, and biometric measurements. All patients underwent small incision cataract surgery with posterior chamber IOL implantation using the SRK/T formula. Postoperative visual acuity was assessed on Day 1, Week 1, and Week 4–6. Data were analyzed using descriptive statistics, and comparison between pre- and postoperative outcomes was performed. Results: The mean age of patients was 64.8 ± 9.2 years, with a slight female predominance. Preoperatively, most patients had visual acuity between 6/36–6/60 (36.4%). On Day 1, good visual outcome (6/6–6/18) was achieved in 88.8% of cases, which remained 56.0% at Week 1 and 30.8% at Week 4–6 due to incomplete follow-up. No poor visual outcomes (<6/60) were observed. There was a statistically significant improvement in vision after surgery ($p<0.001$). Conclusion: Phacoemulsification with IOL implantation is a safe and effective procedure for age-related cataract, providing significant improvement in visual acuity with excellent early postoperative outcomes.

Keywords

Age-related Cataract, Phacoemulsification, Intraocular Lens, Visual Outcome, Visual Acuity

1. Introduction

Cataract is defined as the opacification of the crystalline lens, leading to progressive deterioration of vision and ultimately blindness if left untreated. It remains the leading cause of reversible blindness worldwide, accounting for a substantial proportion of visual impairment, particularly among the elderly population [1] Aging is the most common risk factor, and age-related (senile) cataract constitutes the majority of cases globally. With increasing life expectancy, the burden of cataract-related blindness continues to

*Correspondence: Dewan Fazle Ghani (drfazleghani@yahoo.com)

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rise, especially in low- and middle-income countries [2].

Cataract surgery is the only definitive treatment for restoring vision, and advancements in surgical techniques have significantly improved postoperative outcomes. Among these techniques, phacoemulsification with intraocular lens (IOL) implantation has become the gold standard procedure due to its safety, effectiveness, and rapid visual rehabilitation. [3] This technique involves emulsifying the opacified lens using ultrasonic energy and replacing it with a foldable artificial lens through a small corneal incision, minimizing surgical trauma and reducing postoperative complications [3, 4].

Visual outcome following cataract surgery is a key indicator of surgical success and quality of eye care services. The World Health Organization (WHO) recommends that at least 80% of operated eyes should achieve good visual acuity (6/6–6/18) postoperatively, and with best correction, this Figure should exceed 90%. [5] Recent studies have shown that phacoemulsification consistently meets or exceeds these standards. For instance, more than 90% of patients achieve good visual outcomes after surgery, highlighting its effectiveness in restoring vision [1].

Several studies have demonstrated significant improvement in visual acuity following phacoemulsification. In a descriptive study of senile cataract patients, the proportion with good vision increased to over 85% postoperatively, with a marked reduction in blindness. [6] Similarly, other studies have reported visual improvement rates exceeding 95% within 1 month after surgery, indicating excellent functional outcomes. [7] Long-term studies also support sustained visual improvement, with more than 96% of patients showing enhanced visual acuity following phacoemulsification [8].

Despite these favorable outcomes, the final visual acuity depends on multiple factors, including patient age, pre-existing ocular conditions (such as glaucoma or macular degeneration), systemic diseases like diabetes mellitus, surgical technique, and intraoperative or postoperative complications. [9] Poor visual outcomes are often associated with coexisting ocular pathologies or complications such as posterior capsular rupture and postoperative inflammation. [7] Additionally, studies have shown that elderly patients and those with systemic comorbidities may experience less visual improvement than younger, healthier individuals [9].

Phacoemulsification also offers advantages over conventional techniques such as extracapsular cataract extraction (ECCE) and manual small incision cataract surgery (MSICS), including faster recovery, reduced surgically induced astigmatism, and better early postoperative visual acuity. [10] However, the ultimate visual outcome is comparable across techniques when performed by experienced surgeons, emphasizing the importance of surgical expertise [11].

In recent years, improvements in biometry, IOL design, and surgical equipment have further enhanced refractive accuracy and visual outcomes after cataract surgery. Advances such as foldable IOLs and precise power calculations allow most patients to achieve near-target refraction and high-quality vision postoperatively [12].

Therefore, evaluating visual outcomes following phacoemulsification with IOL implantation is essential for assessing the effectiveness of surgical intervention and identifying factors influencing postoperative vision. This study aims to assess visual outcomes in patients with age-related cataract undergoing phacoemulsification with intraocular lens implantation and to identify factors associated with postoperative visual acuity.

2. Objectives

The main objective was to evaluate the visual outcome following phacoemulsification with intraocular lens implantation in patients with age-related cataract.

3. Methodology & Materials

This prospective observational study was conducted in the Department of Ophthalmology at Zainul Haque Sikder Women's Medical College & Hospital (Pvt.) Ltd., Dhanmondi, Dhaka, and Marium Eye Hospital over a period of four years, from March 2022 to February 2026.

A total of 250 patients diagnosed with age-related (senile) cataract and scheduled for phacoemulsification with intraocular lens (IOL) implantation were included. Patients were selected by purposive sampling according to predefined inclusion and exclusion criteria. Ethical approval was obtained from the Institutional Ethical Review Committee of the respective institutions, and written informed consent was taken from all participants. Patients aged ≥40 years with clinically diagnosed age-related cataract and planned for elective phacoemulsification were included. Patients with traumatic, congenital, or complicated cataract, previous intraocular surgery, corneal opacity, glaucoma, uveitis, retinal pathology (e.g., diabetic retinopathy, macular degeneration), or any ocular condition likely to affect postoperative visual outcome were excluded. A comprehensive preoperative evaluation was performed, including detailed history, visual acuity assessment using Snellen's chart, slit-lamp biomicroscopy, intraocular pressure measurement by Goldmann applanation tonometry, and dilated fundus examination. In cases where fundus visualization was not possible, B-scan ultrasonography was planned as indicated. Biometric measurements were obtained using A-scan ultrasonography and keratometry to calculate IOL power using the SRK/T formula. All patients underwent phacoemulsification under local anesthesia using a standardized technique. A clear corneal incision was made, followed by continuous curvilinear capsulorhexis, hydrodissection, phacoemulsification of the nucleus, cortical aspiration, and implantation of a foldable posterior chamber intraocular lens into the capsular bag. All surgeries were performed by experienced surgeons to maintain uniformity. Postoperative manage-

ment included topical antibiotics and corticosteroids in tapering doses. Patients were followed up on postoperative Day 1, Week 1, and Week 4–6. At each visit, visual acuity and pinhole visual acuity were assessed, and slit-lamp examination was performed to detect complications. The primary outcome measure was postoperative visual acuity, categorized according to WHO guidelines as good (6/6–6/18), borderline (6/24–6/60), and poor (<6/60). Secondary outcomes included postoperative complications and refractive outcome where available.

Data were collected using a structured data sheet. Quantitative variables were expressed as mean ± standard deviation, and qualitative variables as frequency and percentage. Statistical analysis was performed using SPSS version 24. The Chi-square test was applied for comparison of categorical variables, and a p-value of <0.05 was considered statistically significant.

4. Result

Table 1. *Baseline Characteristics of the Patients (n=250).*

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	40–49	12	4.8
	50–59	58	23.2
	60–69	104	41.6
	70–79	60	24
	≥80	16	6.4
Mean ± SD	64.8 ± 9.2 years		
Gender	Male	118	47.2
	Female	132	52.8
Blood Pressure	Normal	78	31.2
	Prehypertensive	122	48.8
	Hypertensive	50	20.0
Blood Sugar	Normal	38	15.2
	Prediabetes	122	48.8
	Diabetes	90	36.0

Table 2. *Pre-operative Visual Acuity (Operated Eye) (n=250).*

Visual Acuity	Frequency (n)	Percentage (%)
6/6–6/12	26	10.4
6/18–6/24	66	26.4
6/36–6/60	91	36.4
CF 1–5 m	51	20.4
HM/PL	16	6.4

Table 1 shows that the majority of patients were in the 60–69 years age group (41.6%), with a mean age of 64.8 ± 9.2 years. Females (52.8%) were slightly more than males (47.2%). Most patients were prehypertensive (48.8%), and 36.0% had diabetes.

Table 2 shows that most patients had poor pre-operative visual acuity, with 36.4% having vision between 6/36–6/60, followed by 26.4% with 6/18–6/24, indicating significant visual impairment before surgery.

Table 3. *Pre-operative Ocular Findings (n=250).*

Parameter	Category	Frequency (n)	Percentage (%)
Operated Eye	Right (OD)	136	54.4
	Left (OS)	114	45.6
IOP	Normal (10–21 mmHg)	218	87.2
	Low	25	10
	Raised	7	2.8
Cataract Type	Mature	248	99.2
	Hypermature	2	0.8

Table 3 shows that the right eye (54.4%) was more commonly operated. All patients had no afferent pupillary defect, and 87.2% had normal intraocular pressure. The vast majority had mature cataract (99.2%).

Table 4. *IOL Power Distribution (n=250).*

IOL Power (D)	Frequency (n)	Percentage (%)
≤20.0	25	10
20.5–22.0	74	29.6
22.5–24.0	71	28.4
24.5–26.0	59	23.6
>26.0	21	8.4

Table 4 shows that the mean IOL power was 23.0 ± 2.47 diopters, with most patients requiring IOL power between

20.5–24.0 D.

Table 5. Postoperative Visual Acuity at Different Follow-up Visits (n = 250).

Visual Acuity	Day 1 n (%)	Week 1 n (%)	Week 4–6 n (%)
6/6	0 (0.0)	4 (1.6)	22 (8.8)
6/9	89 (35.6)	48 (19.2)	20 (8.0)
6/12	93 (37.2)	73 (29.2)	23 (9.2)
6/18	40 (16.0)	15 (6.0)	12 (4.8)
6/24	18 (7.2)	7 (2.8)	0 (0.0)
6/36	5 (2.0)	1 (0.4)	0 (0.0)
6/60	5 (2.0)	1 (0.4)	0 (0.0)
Not Recorded	0 (0.0)	101 (40.4)	173 (69.2)
Total	250 (100)	250 (100)	250 (100)

Table 5 shows that postoperative visual acuity improved markedly. On Day 1, most patients achieved 6/12 (37.2%) and 6/9 (35.6%) vision. However, follow-up data decreased at Week 1 and Week 4–6.

Table 6. Postoperative Visual Outcome Category at Different Follow-up Visits (n = 250).

Outcome Category	Day 1 n (%)	Week 1 n (%)	Week 4–6 n (%)
Good Vision (6/6–6/18)	222 (88.8)	140 (56.0)	77 (30.8)
Borderline Vision (6/24–6/60)	28 (11.2)	9 (3.6)	0 (0.0)
Poor Vision (<6/60)	0 (0.0)	0 (0.0)	0 (0.0)
Not Recorded	0 (0.0)	101 (40.4)	173 (69.2)
Total	250 (100)	250 (100)	250 (100)

Table 6 shows that good visual outcome (6/6–6/18) was achieved in 88.8% of patients on Day 1, indicating excellent surgical outcome. No patient had poor vision (<6/60).

Table 7. Pre-operative vs Post-operative Visual Outcome.

Visual Outcome	Pre-operative n (%)	Day 1 post-operative n (%)	p-value
Good vision (6/6–6/18)	92 (36.8)	222 (88.8)	<0.001
Borderline vision (6/24–6/60)	91 (36.4)	28 (11.2)	
Poor vision (<6/60)	67 (26.8)	0 (0.0)	
Total	250 (100)	250 (100)	

Table 7 shows a significant improvement in visual outcome after surgery, with good vision increasing from 36.8% preoperatively to 88.8% postoperatively ($p < 0.001$).

Table 8. Association of Age Group with Day 1 Visual Outcome.

Age Group	Good Vision	Borderline Vision	Poor Vision	Total	p-value
40–49	11	1	0	12	0.34
50–59	54	4	0	58	
60–69	91	13	0	104	
70–79	50	10	0	60	
≥80	16	0	0	16	
Total	222	28	0	250	

Table 8 shows that there was no statistically significant association between age and postoperative visual outcome (p = 0.34).

Table 9. *Refraction and Final Visual Outcome (n = 250).*

Variable	Category	Frequency (n)	Percentage (%)
Refraction Status	Glasses provided	46	18.4
	Not provided	12	4.8
	Not recorded	192	76.8
BCVA (n = 58)	6/6	26	44.8
	6/9	15	25.9
	6/12	7	12.1
	6/24–6/60	10	17.2

Table 9 shows that refraction was performed in a subset of patients, where 18.4% received glasses. Among those, 44.8% achieved 6/6 vision, indicating excellent final visual outcome.

5. Discussion

The present study evaluated the visual outcomes following phacoemulsification with intraocular lens implantation in patients with age-related cataract. In this study, the mean age of patients was 64.8 ± 9.2 years, with the majority in the 60–69 years age group. This is comparable to a study in Frontiers in Medicine, which reported a mean age of 66.39 ± 9.48 years, indicating that cataract predominantly affects the elderly population. [13] Preoperatively, most patients had moderate to severe visual impairment, with the largest proportion (36.4%) having visual acuity between 6/36–6/60. Similar findings have been reported in multiple studies, in which patients typically present late with poor vision in developing countries due to delayed healthcare access. [14] Postoperatively, a marked improvement in visual outcome was observed. In the present study, 88.8% of patients achieved good visual acuity (6/6–6/18) on Day 1, a rate higher than reported in many previous studies. According to a study published in BMJ Open, most patients achieved functional vision (around 6/12) after cataract surgery. [14] Similarly, another study reported 81.83% good visual outcome, which is close to the WHO-recommended standard of ≥90%. [15] The slightly higher success rate in the present study may be due to careful patient selection and the absence of ocular comorbidities. The significant improvement from 36.8% good vision preoperatively to 88.8% postoperatively ($p < 0.001$) confirms the effectiveness of phacoemulsification. This finding is consistent with studies showing that cataract surgery results in substantial visual improvement, with improvement observed in more than 70% of patients. [13] Moreover, phacoemulsification is considered one of the safest surgical procedures, with success rates exceeding 92–95%. [16] At Week 1 and Week 4–6 follow-up, all recorded cases maintained good visual outcomes, and no patient developed poor vision (<6/60). This is comparable to findings from other studies, which show that long-term visual improvement was sustained and that poor outcomes were minimal. [9] However, the high loss-to-follow-up rate (40–70%) in this study limits long-term comparisons. The present study also found no significant association between age and visual outcome (p = 0.34). This finding is supported by other studies, which reported that age alone does not significantly influence postoperative visual outcome, provided there are no associated ocular comorbidities. [8] However, some studies suggest that very advanced age may slightly reduce visual improvement due to associated systemic and ocular conditions. Regarding surgical technique, all cases were performed using SICS with posterior chamber IOL implantation. Previous studies have shown that SICS and phacoemulsification provide comparable visual outcomes, although phacoemulsification may offer faster visual rehabilitation. [17] This supports the effectiveness of the surgical approach used in the present study. Regarding refractive outcome, 44.8% of patients achieved 6/6 best-corrected visual acuity, comparable to studies reporting high rates of excellent visual acuity after correction. [18] Residual refractive error remains a known factor affecting final visual acuity. Importantly, no postoperative complications were observed in this study. This aligns with literature indicating that modern cataract surgery has a low complication rate and high safety profile. [11] Overall, the present study's findings demonstrate that cataract surgery with intraocular lens implantation is a highly effective and safe procedure for visual rehabilitation in patients with age-related cataract. The significant improvement in postoperative visual acuity, high proportion of good visual outcomes, and absence of complications highlight the reliability of the surgical technique. These results are consistent with both regional and international studies, reinforcing the role of modern cataract surgery in reducing visual impairment and blindness.

6. Limitations of the Study

This study was conducted in a single center with a relatively high loss to follow-up at Week 1 and Week 4–6, which may affect long-term outcome assessment. Postoperative refraction was not available for all patients, and other influencing factors such as comorbidities and surgical variables were not fully analyzed.

7. Conclusion

Phacoemulsification with intraocular lens implantation demonstrated excellent visual outcomes in patients with age-related cataract. A significant proportion of patients achieved

good vision (6/6–6/18) as early as Day 1, with sustained improvement during follow-up. No cases of poor visual outcome were observed, indicating the procedure is safe and highly effective. Overall, timely surgical intervention leads to substantial visual rehabilitation and improved quality of life across all age groups.

Abbreviations

IOL	Intraocular Lens
WHO	World Health Organization
ECCE	Extracapsular Cataract Extraction
MSICS	Manual Small Incision Cataract Surgery
IOP	Intraocular Pressure
SRK/T	Sanders-Retzlaff-Kraff/Theoretical (IOL Power Formula)
CF	Counting Fingers
HM	Hand Movements
PL	Perception of Light
OD	Oculus Dexter (Right Eye)
OS	Oculus Sinister (Left Eye)
D	Diopters
BCVA	Best-Corrected Visual Acuity
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences

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Author Contributions

Dewan Fazle Ghani: Conceptualization, Formal Analysis, Visualization, Writing – original draft

Arif Hayat Khan Pathan: Resources, Supervision, Writing – review & editing

Fakhrul Islam: Methodology, Data curation, Validation

Rafia Islam Jui: Investigation, Data curation, Writing – review & editing

Conflicts of Interest

There are no conflicts of interest.

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