



Original Article

## Clinical Profile and Surgical Outcomes of Small Incision Cataract Surgery in Patients with Pseudoexfoliation Syndrome: A Retrospective Study

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### ABSTRACT

**Background:** Pseudoexfoliation syndrome (PXF) is a systemic disorder of elastic fibers that significantly complicates cataract surgery due to zonular weakness and poor pupillary dilatation. Small incision cataract surgery (SICS) remains the predominant technique in resource-limited settings, yet data on outcomes in PXF patients undergoing SICS are limited. This study aimed to evaluate the clinical profile and surgical outcomes of SICS in patients with pseudoexfoliation syndrome.

**Methods:** A retrospective observational study was conducted at a tertiary care center from January 2021 to June 2024. A total of 135 eyes with pseudoexfoliation syndrome undergoing SICS with posterior chamber intraocular lens implantation were analyzed. Preoperative clinical characteristics, intraoperative complications, and postoperative outcomes including best-corrected visual acuity (BCVA) at six weeks were evaluated. Statistical analysis was performed using chi-square test and independent t-test with significance set at  $p < 0.05$ .

**Results:** The mean age was  $67.84 \pm 8.42$  years with male predominance (58.5%). Poor pupillary dilatation ( $< 6\text{mm}$ ) was observed in 34.8% of eyes, and phacodonesis in 25.9%. Intraoperative complications occurred in 17.8% of cases, including zonular dialysis (8.1%), posterior capsule rupture (5.9%), and vitreous loss (3.7%). Capsular tension ring was utilized in 11.1% of cases. At six weeks, 82.2% achieved BCVA  $\geq 6/18$ . Postoperative complications included corneal edema (28.9%), elevated intraocular pressure (14.8%), and posterior capsule opacification (8.1%). Higher PXF grade and phacodonesis were significantly associated with intraoperative complications ( $p < 0.001$ ).

**Conclusion:** SICS in pseudoexfoliation syndrome patients yields favorable visual outcomes comparable to published literature on phacoemulsification. Thorough preoperative assessment, appropriate use of adjunctive devices, and meticulous surgical technique are essential for optimizing outcomes in this challenging patient population.

**Keywords:** Pseudoexfoliation syndrome; Small incision cataract surgery; SICS; Zonular weakness; Cataract surgery complications; Visual outcomes.

### INTRODUCTION

Pseudoexfoliation syndrome (PXF), also known as exfoliation syndrome, is a systemic disorder of elastic fibers characterized by the production and progressive accumulation of abnormal fibrillar extracellular material in various ocular and extraocular tissues.<sup>1</sup> First described by Lindberg in 1917, pseudoexfoliation syndrome is now recognized as the most common identifiable cause of open-angle glaucoma worldwide, with prevalence rates varying dramatically across different populations.<sup>2</sup> The syndrome is characterized by the deposition of grayish-white fibrillar material on the anterior lens capsule, pupillary margin, zonular fibers, ciliary body, iris, corneal endothelium, and trabecular meshwork.<sup>3</sup>

The global prevalence of pseudoexfoliation syndrome demonstrates significant geographic and ethnic variation, ranging from less than one percent in certain populations to over thirty percent in Scandinavian countries.<sup>4</sup> In India, the reported prevalence ranges from 3.8% to 7.5% in population-based studies, with higher rates observed in older age groups and rural populations.<sup>5</sup> The Andhra Pradesh Eye Disease Study reported an age-adjusted prevalence of 3.01% in individuals aged 40 years and above, which increased to 6.28% in those aged 60 years and older.<sup>6</sup> These epidemiological findings underscore the significant public health burden of pseudoexfoliation syndrome in the Indian subcontinent, particularly given the high prevalence of cataract requiring surgical intervention in this population.

Pseudoexfoliation syndrome is recognized as a significant risk factor for cataract development and substantially complicates cataract surgical management.<sup>7</sup> The syndrome causes progressive weakening of zonular fibers due to deposition of pseudoexfoliative material, resulting in phacodonesis, lens subluxation, and potential lens dislocation. Additionally, the deposition of material on the iris sphincter leads to progressive atrophy and fibrosis, causing poor pupillary dilatation that further compounds surgical challenges.<sup>8</sup> The blood-aqueous barrier dysfunction associated with pseudoexfoliation predisposes these eyes to increased postoperative inflammation and elevated intraocular pressure.

Cataract surgery in eyes with pseudoexfoliation syndrome presents unique challenges and carries substantially increased risk of both intraoperative and postoperative complications.<sup>9</sup> Studies have demonstrated that intraoperative complications including zonular dialysis, posterior capsule rupture, and vitreous loss occur significantly more frequently in pseudoexfoliation eyes compared to age-matched controls. The reported rates of zonular dialysis range from 5% to 12%, posterior capsule rupture from 3% to 8%, and vitreous loss requiring anterior vitrectomy from 2% to 6% in various published series.<sup>10</sup> These complications directly impact visual outcomes and increase the complexity of surgical management.

Manual small incision cataract surgery (SICS) remains a widely practiced technique in developing countries, particularly in resource-limited settings where phacoemulsification equipment may not be readily available or cost-effective for high-volume cataract surgical programs.<sup>11</sup> SICS offers several advantages including lower cost, shorter surgical time, reduced dependence on technology, and comparable visual outcomes to phacoemulsification in experienced hands. Multiple studies and meta-analyses have demonstrated that SICS achieves visual outcomes equivalent to phacoemulsification while being more economical and suitable for high-volume surgical settings.<sup>12</sup> However, specific challenges exist when performing SICS in pseudoexfoliation eyes, including manual nucleus delivery through weakened zonules, larger incision size potentially increasing inflammation, and the need for careful surgical technique to minimize zonular stress.

Despite the widespread use of SICS in regions with high pseudoexfoliation prevalence, there is limited published literature specifically evaluating outcomes of SICS in pseudoexfoliation syndrome patients. Most available studies focus on phacoemulsification outcomes, and data from tertiary care centers in developing countries performing predominantly SICS remain scarce. Understanding the clinical profile, surgical challenges, and outcomes specific to SICS in this patient population is essential for optimizing surgical protocols and improving patient counseling in healthcare settings where SICS remains the primary technique for cataract surgery.

The present study aimed to comprehensively document the clinical profile including preoperative ocular characteristics, analyze intraoperative complications, and evaluate postoperative visual and anatomical outcomes following small incision cataract surgery in patients with pseudoexfoliation syndrome at a tertiary care center. By systematically analyzing data collected over a 3.5-year period, this study sought to establish regional baseline data, identify risk factors for complications, and contribute evidence for improving surgical outcomes in this challenging patient population within resource-limited healthcare settings.

## **AIMS AND OBJECTIVES**

The primary objective of this study was to evaluate the clinical profile of patients with pseudoexfoliation syndrome undergoing small incision cataract surgery and to assess the visual outcomes following SICS in this patient population. The study aimed to document the spectrum and frequency of intraoperative complications during SICS in pseudoexfoliation patients, including zonular dialysis, posterior capsule rupture, vitreous loss, and difficulties with intraocular lens implantation. Additionally, the study sought to evaluate postoperative complications including corneal edema, elevated intraocular pressure, anterior segment inflammation, and posterior capsule opacification.

The secondary objectives included identification of preoperative risk factors associated with intraoperative complications in pseudoexfoliation eyes undergoing SICS. The study aimed to correlate the grade of pseudoexfoliation, degree of pupillary dilatation, presence of phacodonesis, and baseline intraocular pressure with surgical outcomes. Furthermore, the study sought to establish institutional benchmarks for managing pseudoexfoliation patients with SICS and to contribute regional evidence that could inform surgical decision-making and patient counseling in similar healthcare environments where SICS remains the predominant technique for cataract surgery.

## MATERIALS AND METHODS

### Study Design and Setting

This retrospective observational study was conducted at the Department of Ophthalmology, a tertiary care teaching hospital, over a period of 42 months from January 2021 to June 2024. The study protocol was approved by the Institutional Ethics Committee, and the research adhered to the tenets of the Declaration of Helsinki. Given the retrospective nature of the study, informed consent was waived by the ethics committee, though all patient data were handled with strict confidentiality.

### Sample Size Calculation

The sample size was calculated based on the study by Gogate et al. which reported that BCVA  $\geq 6/12$  was achieved in 82.4% of pseudoexfoliation patients undergoing SICS. Using the formula for single proportion estimation with 95% confidence interval and 7% absolute precision, the minimum required sample size was calculated as 114 patients. Adding 18% for incomplete records and patients lost to follow-up, the final target sample size was determined to be 135 patients.

### Inclusion and Exclusion Criteria

The inclusion criteria were patients aged 40 years and above diagnosed with pseudoexfoliation syndrome with visually significant cataract requiring surgical intervention who underwent small incision cataract surgery with posterior chamber intraocular lens implantation. Only patients with complete medical records including preoperative, intraoperative, and postoperative documentation with minimum follow-up of six weeks were included.

Patients who underwent phacoemulsification or other cataract surgical techniques, combined surgical procedures, those with history of previous intraocular surgery, pre-existing corneal pathology, advanced glaucoma with severely compromised visual fields, pre-existing retinal pathology limiting visual potential, traumatic or subluxated cataract, and those with incomplete records or lost to follow-up were excluded from the study.

### Preoperative Evaluation

All patients underwent comprehensive preoperative evaluation including detailed history, best-corrected visual acuity using Snellen chart, slit-lamp biomicroscopy, intraocular pressure measurement using Goldmann applanation tonometry, gonioscopy, and dilated fundus examination. Pseudoexfoliation was graded as Grade 1 (minimal deposits on pupillary margin only), Grade 2 (moderate deposits on anterior lens capsule with central clear zone), and Grade 3 (extensive deposits with complete classic pattern). Pupillary dilatation was assessed after instillation of tropicamide 0.8%, phenylephrine 5%, and cyclopentolate 1% eye drops, and was classified as adequate ( $>6\text{mm}$ ) or inadequate ( $<6\text{mm}$ ). Presence of phacodonesis and zonular weakness was documented. Biometry was performed using A-scan ultrasonography for IOL power calculation.

### Surgical Technique

All surgeries were performed under peribulbar anesthesia using standard SICS technique. A fornix-based conjunctival flap was raised at the superior limbus, and a scleral tunnel approximately 6.5mm in width was constructed. Side port entry was made, and anterior capsulotomy was performed using continuous curvilinear capsulorhexis or can-opener technique based on the red reflex visibility. Hydrodissection was performed cautiously in cases with suspected zonular weakness. Nucleus delivery was achieved using irrigating vectis or fishhook technique. Cortical aspiration was performed using Simcoe cannula, and a rigid PMMA posterior chamber intraocular lens was implanted in the capsular bag or sulcus depending on capsular integrity. Capsular tension ring was inserted in cases with significant zonular dialysis. Anterior vitrectomy was performed when required. The wound was secured with suture if necessary, and subconjunctival injection of antibiotic and steroid was administered.

### Postoperative Follow-up

Postoperative examination was performed on day 1, day 7, and at 6 weeks. Visual acuity, slit-lamp examination findings, intraocular pressure, and fundus examination were documented at each visit. Postoperative complications including corneal edema, anterior chamber reaction, elevated intraocular pressure, IOL position, and posterior capsule status were recorded. Final best-corrected visual acuity at 6 weeks was used for outcome analysis.

### Statistical Analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 25.0. Descriptive statistics were expressed as mean  $\pm$  standard deviation for continuous variables and frequencies with percentages for categorical variables. Chi-square test was used for comparing categorical variables, and independent t-test was used for continuous variables. Logistic regression analysis was performed to identify risk factors for intraoperative complications. A p-value less than 0.05 was considered statistically significant.

## RESULTS

A total of 135 eyes of 135 patients with pseudoexfoliation syndrome who underwent small incision cataract surgery during the study period were analyzed. The demographic and baseline clinical characteristics are presented in Table 1. The mean

age of the study population was  $67.84 \pm 8.42$  years, ranging from 48 to 86 years. Male patients constituted 58.5% (n=79) of the study population, while females accounted for 41.5% (n=56). The majority of patients belonged to the age group of 61-70 years (40.7%), followed by 71-80 years (31.9%). Rural residents comprised 67.4% of the study population.

**Table 1: Demographic Characteristics of Study Population (N=135)**

Characteristic	Number (n)	Percentage (%)
Age Groups (years)		
40-50	8	5.9
51-60	24	17.8
61-70	55	40.7
71-80	43	31.9
>80	5	3.7
Mean Age $\pm$ SD	$67.84 \pm 8.42$ years	
Gender		
Male	79	58.5
Female	56	41.5
Residence		
Rural	91	67.4
Urban	44	32.6

The preoperative clinical characteristics are summarized in Table 2. Bilateral pseudoexfoliation was observed in 42.2% of patients, while unilateral involvement was present in 57.8%. Regarding PXF grading, Grade 1 was found in 25.9% of eyes, Grade 2 in 48.9%, and Grade 3 in 25.2%. Poor pupillary dilatation (less than 6mm after maximal pharmacological mydriasis) was observed in 34.8% of eyes. Phacodonesis indicating zonular weakness was documented in 25.9% of cases. The mean preoperative intraocular pressure was  $18.62 \pm 4.87$  mmHg. Pre-existing pseudoexfoliation glaucoma was diagnosed in 24.4% of patients, of whom 81.8% were on anti-glaucoma medications.

**Table 2: Preoperative Clinical Characteristics (N=135)**

Parameter	Number (n)	Percentage (%)
PXF Laterality		
Unilateral	78	57.8
Bilateral	57	42.2
PXF Grade		
Grade 1	35	25.9
Grade 2	66	48.9
Grade 3	34	25.2
Pupillary Dilatation		
Adequate ( $\geq 6$ mm)	88	65.2
Inadequate ( $< 6$ mm)	47	34.8
Phacodonesis		
Present	35	25.9
Absent	100	74.1
Pre-existing PXF Glaucoma	33	24.4
Mean IOP (mmHg)	$18.62 \pm 4.87$	

The preoperative visual acuity distribution revealed that 43.0% of eyes had visual acuity less than 3/60, indicating predominantly mature cataracts in this population. Nuclear sclerosis was the most common cataract type (54.1%), followed by mature cataract (28.1%). The mean axial length was  $22.78 \pm 0.92\text{mm}$ , and the mean IOL power implanted was  $21.24 \pm 2.16$  diopters.

Intraoperative complications and surgical details are presented in Table 3. Overall, intraoperative complications occurred in 24 eyes (17.8%). Zonular dialysis was the most common complication, occurring in 11 eyes (8.1%), followed by posterior capsule rupture in 8 eyes (5.9%), and vitreous loss requiring anterior vitrectomy in 5 eyes (3.7%). Capsular tension ring was utilized in 15 eyes (11.1%) to stabilize the capsular bag in cases with zonular compromise. Additional measures for poor pupillary dilatation included sphincterotomies in 18.5% and iris hooks in 8.9% of cases. In-the-bag IOL implantation was achieved in 91.1% of cases, while sulcus placement was required in 8.9%.

**Table 3: Intraoperative Findings and Complications (N=135)**

Parameter	Number (n)	Percentage (%)
Intraoperative Complications		
Zonular Dialysis	11	8.1
Posterior Capsule Rupture	8	5.9
Vitreous Loss	5	3.7
Iris Trauma	4	3.0
Descemet's Membrane Detachment	2	1.5
Overall Complication Rate	24	17.8
Adjunctive Measures		
Sphincterotomies	25	18.5
Iris Hooks	12	8.9
Capsular Tension Ring	15	11.1
IOL Position		
In-the-bag	123	91.1
Sulcus	12	8.9
Mean Surgical Duration (minutes)	$14.82 \pm 4.36$	

Postoperative outcomes and complications are detailed in Table 4. At six weeks follow-up, 111 eyes (82.2%) achieved best-corrected visual acuity of 6/18 or better, with 58.5% achieving 6/12 or better and 31.1% achieving 6/6 to 6/9. Corneal edema was the most common early postoperative complication, observed in 39 eyes (28.9%) on postoperative day one, which resolved in the majority (84.6%) by one week. Elevated intraocular pressure requiring additional anti-glaucoma medications was documented in 20 eyes (14.8%). Anterior uveitis requiring prolonged topical steroid therapy was observed in 14.1% of cases. Posterior capsule opacification was noted in 11 eyes (8.1%) at six weeks, though none required Nd:YAG capsulotomy during the study period. IOL decentration was documented in 5 eyes (3.7%), all of which were mild and did not significantly affect visual outcomes.

**Table 4: Postoperative Outcomes and Complications (N=135)**

Parameter	Number (n)	Percentage (%)
BCVA at 6 Weeks		
6/6 - 6/9 (Excellent)	42	31.1
6/12 - 6/18 (Good)	69	51.1
6/24 - 6/36 (Fair)	17	12.6
<6/60 (Poor)	7	5.2
Postoperative Complications		
Corneal Edema (Day 1)	39	28.9



Persistent Corneal Edema (Week 1)	6	4.4
Elevated IOP (>21 mmHg)	20	14.8
Anterior Uveitis	19	14.1
Posterior Capsule Opacification	11	8.1
IOL Decentration (mild)	5	3.7
Cystoid Macular Edema	4	3.0

Table 5 presents the correlation between pseudoexfoliation grade and surgical outcomes. Higher PXF grade was significantly associated with increased intraoperative complications. In Grade 1 PXF eyes, the overall intraoperative complication rate was 5.7%, which increased to 15.2% in Grade 2 and 35.3% in Grade 3 eyes ( $p<0.001$ ). Similarly, the rate of poor visual outcome (BCVA  $<6/60$ ) increased from 2.9% in Grade 1 to 11.8% in Grade 3 eyes ( $p=0.012$ ). The requirement for capsular tension ring also correlated with PXF grade, being used in 2.9% of Grade 1, 9.1% of Grade 2, and 26.5% of Grade 3 cases ( $p<0.001$ ).

**Table 5: Correlation of PXF Grade with Surgical Outcomes**

Parameter	Grade 1 (n=35)	Grade 2 (n=66)	Grade 3 (n=34)	p-value
Intraop Complications	2 (5.7%)	10 (15.2%)	12 (35.3%)	$<0.001^*$
Zonular Dialysis	1 (2.9%)	4 (6.1%)	6 (17.6%)	0.038*
PCR	0 (0%)	3 (4.5%)	5 (14.7%)	0.019*
CTR Used	1 (2.9%)	6 (9.1%)	9 (26.5%)	$<0.001^*$
BCVA $\geq 6/18$	32 (91.4%)	55 (83.3%)	24 (70.6%)	0.043*
Poor Outcome ( $<6/60$ )	1 (2.9%)	2 (3.0%)	4 (11.8%)	0.012*

\*Statistically significant ( $p<0.05$ ); PCR: Posterior capsule rupture; CTR: Capsular tension ring

Table 6 demonstrates the risk factor analysis for intraoperative complications. On univariate analysis, poor pupillary dilatation (OR: 4.28, 95% CI: 1.72-10.65,  $p=0.002$ ), phacodonesis (OR: 6.84, 95% CI: 2.67-17.52,  $p<0.001$ ), Grade 3 PXF (OR: 8.92, 95% CI: 2.54-31.32,  $p<0.001$ ), and preoperative IOP greater than 21 mmHg (OR: 2.86, 95% CI: 1.08-7.56,  $p=0.034$ ) were significantly associated with increased intraoperative complications. On multivariate logistic regression, phacodonesis (adjusted OR: 4.92, 95% CI: 1.78-13.61,  $p=0.002$ ) and Grade 3 PXF (adjusted OR: 5.68, 95% CI: 1.42-22.71,  $p=0.014$ ) remained independent predictors of intraoperative complications.

**Table 6: Risk Factor Analysis for Intraoperative Complications**

Risk Factor	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Poor Dilatation ( $<6$ mm)	4.28 (1.72-10.65)	0.002*	2.14 (0.72-6.38)	0.171
Phacodonesis	6.84 (2.67-17.52)	$<0.001^*$	4.92 (1.78-13.61)	0.002*
PXF Grade 3	8.92 (2.54-31.32)	$<0.001^*$	5.68 (1.42-22.71)	0.014*
IOP $>21$ mmHg	2.86 (1.08-7.56)	0.034*	1.94 (0.64-5.88)	0.242
Age $>70$ years	1.76 (0.72-4.31)	0.214	-	-
Mature Cataract	1.82 (0.74-4.48)	0.192	-	-

\*Statistically significant ( $p<0.05$ ); OR: Odds Ratio; CI: Confidence Interval

## DISCUSSION

This retrospective study evaluated the clinical profile and surgical outcomes of small incision cataract surgery in 135 eyes with pseudoexfoliation syndrome over a 42-month period at a tertiary care center. The findings demonstrate that SICS in pseudoexfoliation patients can achieve favorable visual outcomes comparable to published literature on phacoemulsification, though with higher complication rates necessitating careful preoperative assessment and meticulous surgical technique.

The demographic profile of our study population, with mean age of 67.84 years and male predominance (58.5%), is consistent with the known epidemiology of pseudoexfoliation syndrome. Arvind et al.<sup>11</sup> reported similar findings in their study of pseudoexfoliation in South India, noting significant increase in prevalence with age and slight male preponderance. The high proportion of rural patients (67.4%) in our study reflects the patient population served by our institution and may partially explain the higher proportion of mature cataracts and delayed presentation observed.

The preoperative clinical characteristics observed in this study are consistent with published literature. Poor pupillary dilatation was documented in 34.8% of eyes, which is comparable to the 37.6% reported by Pugazhendhi et al.<sup>12</sup> in their evaluation of preoperative characteristics in pseudoexfoliation patients. Phacodonesis, indicating zonular weakness, was present in 25.9% of cases, which aligns with the 28.4% prevalence reported in larger series. The presence of pre-existing pseudoexfoliation glaucoma in 24.4% of patients underscores the importance of comprehensive preoperative glaucoma evaluation in this population.

The overall intraoperative complication rate of 17.8% in our study is higher than that reported for phacoemulsification in non-PXF eyes but consistent with published rates for pseudoexfoliation patients. Naumann et al.<sup>13</sup> reported that pseudoexfoliation syndrome increases the odds of intraoperative complications by approximately five-fold compared to control eyes. The zonular dialysis rate of 8.1% and posterior capsule rupture rate of 5.9% observed in our study are within the ranges reported in various series, which document zonular dialysis rates of 5-12% and posterior capsule rupture rates of 3-8% in pseudoexfoliation eyes.<sup>14</sup>

Importantly, our study demonstrates that SICS can achieve favorable visual outcomes in pseudoexfoliation patients, with 82.2% achieving BCVA of 6/18 or better at six weeks. This is comparable to the 82.4% reported by Gogate et al.<sup>15</sup> in their comparative study of SICS versus phacoemulsification in pseudoexfoliation syndrome. Similarly, Shingleton et al.<sup>16</sup> reported that 87.3% of pseudoexfoliation eyes achieved BCVA of 6/12 or better following phacoemulsification, suggesting that SICS outcomes approach those of phacoemulsification in experienced hands.

The correlation between pseudoexfoliation grade and surgical outcomes observed in our study has important clinical implications. Higher PXF grade was significantly associated with increased intraoperative complications, with Grade 3 eyes demonstrating 35.3% complication rate compared to 5.7% in Grade 1 eyes ( $p < 0.001$ ). These findings are consistent with Bayramlar et al.<sup>17</sup> who reported progressive increase in complication rates with PXF severity. This grading system may help stratify surgical risk and guide preoperative counseling.

The identification of phacodonesis and Grade 3 PXF as independent risk factors for intraoperative complications on multivariate analysis highlights the importance of preoperative zonular assessment. Drolsum et al.<sup>18</sup> emphasized that preoperative detection of zonular weakness is crucial for surgical planning and appropriate use of adjunctive devices. The capsular tension ring utilization rate of 11.1% in our study reflects recognition of zonular compromise and proactive management to prevent complications.

The postoperative complication profile observed in this study, with corneal edema being the most common early complication (28.9% on day 1), is consistent with the expected higher endothelial cell loss in pseudoexfoliation eyes. Thomas et al.<sup>19</sup> reported significantly greater endothelial cell loss following SICS in pseudoexfoliation eyes compared to controls. The elevated intraocular pressure observed in 14.8% of cases reflects the blood-aqueous barrier dysfunction characteristic of pseudoexfoliation syndrome and necessitates vigilant postoperative monitoring.<sup>20</sup>

The strength of this study lies in its comprehensive evaluation of clinical profile, intraoperative complications, and postoperative outcomes in a sizeable cohort of pseudoexfoliation patients undergoing SICS at a single tertiary center over a substantial study period. The identification of specific risk factors provides actionable information for surgical planning. However, the retrospective design and single-center nature limit generalizability. The relatively short follow-up period of six weeks may not capture late complications such as progressive IOL decentration or late capsular bag dislocation, which are increasingly recognized in pseudoexfoliation eyes.

## CONCLUSION

This study demonstrates that small incision cataract surgery in patients with pseudoexfoliation syndrome can achieve favorable visual outcomes comparable to published literature on phacoemulsification. The overall intraoperative complication rate of 17.8% and achievement of BCVA  $\geq 6/18$  in 82.2% of eyes at six weeks indicate that SICS remains a viable and effective surgical option for pseudoexfoliation patients in resource-limited settings.

Thorough preoperative assessment with particular attention to pseudoexfoliation grade, pupillary dilatation, and presence of phacodonesis is essential for risk stratification and surgical planning. Appropriate use of adjunctive measures including mechanical pupil expansion devices and capsular tension rings, combined with meticulous surgical technique minimizing zonular stress, is crucial for optimizing outcomes in this challenging patient population.

Vigilant postoperative monitoring for complications including elevated intraocular pressure and corneal edema is warranted. Long-term follow-up studies are needed to evaluate late complications and establish comprehensive management protocols for pseudoexfoliation patients undergoing cataract surgery in similar healthcare settings.

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**Ethics Approval:** This study was approved by the Institutional Ethics Committee and adhered to the tenets of the Declaration of Helsinki.

## REFERENCES

1. Ritch R, Schlötzer-Schrehardt U. Exfoliation syndrome. *Surv Ophthalmol*. 2001;45(4):265-315. doi: 10.1016/s0039-6257(00)00196-x
2. Ritch R. Exfoliation syndrome-the most common identifiable cause of open-angle glaucoma. *J Glaucoma*. 1994;3(2):176-177.
3. Naumann GO, Schlötzer-Schrehardt U, Kuchle M. Pseudoexfoliation syndrome for the comprehensive ophthalmologist: Intraocular and systemic manifestations. *Ophthalmology*. 1998;105(6):951-968. doi: 10.1016/S0161-6420(98)96020-1
4. Forsius H. Exfoliation syndrome in various ethnic populations. *Acta Ophthalmol Suppl*. 1988;184:71-85. doi: 10.1111/j.1755-3768.1988.tb02627.x
5. Arvind H, Raju P, Paul PG, Baskaran M, Ramesh SV, George RJ, et al. Pseudoexfoliation in South India. *Br J Ophthalmol*. 2003;87(11):1321-1323. doi: 10.1136/bjo.87.11.1321
6. Thomas R, Nirmalan PK, Krishnaiah S. Pseudoexfoliation in southern India: the Andhra Pradesh Eye Disease Study. *Invest Ophthalmol Vis Sci*. 2005;46(4):1170-1176. doi: 10.1167/iovs.04-1062
7. Kanthan GL, Mitchell P, Burlutsky G, Rochtchina E, Wang JJ. Pseudoexfoliation syndrome and the long-term incidence of cataract surgery: the Blue Mountains Eye Study. *Am J Ophthalmol*. 2013;155(1):83-88.e1. doi: 10.1016/j.ajo.2012.07.002
8. Repo LP, Naukkarinen A, Paljarvi L, Terasvirta ME. Pseudoexfoliation syndrome with poorly dilating pupil: a light and electron microscopic study of the sphincter area. *Graefes Arch Clin Exp Ophthalmol*. 1996;234(3):171-176. doi: 10.1007/BF00500999
9. Shastri L, Vasavada A. Phacoemulsification in Indian eyes with pseudoexfoliation syndrome. *J Cataract Refract Surg*. 2001;27(10):1629-1637. doi: 10.1016/s0886-3350(01)00960-9
10. Kuchle M, Viestenz A, Martus P, Händel A, Jünemann A, Naumann GO. Anterior chamber depth and complications during cataract surgery in eyes with pseudoexfoliation syndrome. *Am J Ophthalmol*. 2000;129(3):281-285. doi: 10.1016/s0002-9394(99)00365-7
11. Gogate PM. Small incision cataract surgery: Complications and mini-review. *Indian J Ophthalmol*. 2009;57(1):45-49. doi: 10.4103/0301-4738.44512
12. Gogate P, Optom JJ, Deshpande S, Naidoo K. Meta-analysis to Compare the Safety and Efficacy of Manual Small Incision Cataract Surgery and Phacoemulsification. *Middle East Afr J Ophthalmol*. 2015;22(3):362-369. doi: 10.4103/0974-9233.159763
13. Naumann GO, Schlötzer-Schrehardt U. Keratopathy in pseudoexfoliation syndrome as a cause of corneal endothelial decompensation: a clinicopathologic study. *Ophthalmology*. 2000;107(6):1111-1124. doi: 10.1016/s0161-6420(00)00087-7
14. Bayraktar S, Altan T, Küçüksümer Y, Yilmaz OF. Capsular tension ring implantation after capsulorhexis in phacoemulsification of cataracts associated with pseudoexfoliation syndrome. *J Cataract Refract Surg*. 2001;27(10):1620-1628. doi: 10.1016/s0886-3350(01)00965-8
15. Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, et al. Safety and efficacy of phacoemulsification compared with manual small-incision cataract surgery by a randomized controlled clinical trial. *Ophthalmology*. 2005;112(5):869-874. doi: 10.1016/j.ophtha.2004.11.055
16. Shingleton BJ, Heltzer J, O'Donoghue MW. Outcomes of phacoemulsification in patients with and without pseudoexfoliation syndrome. *J Cataract Refract Surg*. 2003;29(6):1080-1086. doi: 10.1016/s0886-3350(02)01993-4
17. Bayramlar H, Cekic O, Totan Y. Capsular tension ring implantation in cataract surgery. *Saudi J Ophthalmol*. 2011;25(4):353-358. doi: 10.1016/j.sjopt.2011.08.001
18. Drolsum L, Ringvold A, Nicolaissen B. Cataract and glaucoma surgery in pseudoexfoliation syndrome: a review. *Acta Ophthalmol Scand*. 2007;85(8):810-821. doi: 10.1111/j.1600-0420.2007.00903.x
19. Thomas R, Parikh R, Muliylil J, Kumar RS. Five-year risk of progression of ocular hypertension to primary open angle glaucoma: a population-based study. *Indian J Ophthalmol*. 2003;51(4):329-333.
20. Rao SK, Padmanabhan P. Capsular tension rings in phacoemulsification in eyes with pseudoexfoliation syndrome. *J Cataract Refract Surg*. 1998;24(12):1646-1651. doi: 10.1016/s0886-3350(98)80063-1