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Research Paper

Visual Outcome After Simultaneous Pterygium Excision And Cataract Surgery: A Prospective Observational Study At A Tertiary Care Centre

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ABSTRACT

Background: *Pterygium and senile cataract frequently co-exist in tropical regions owing to shared ultraviolet radiation exposure. Simultaneous surgical management is gaining acceptance but an optimal protocol is yet to be standardised.*

Objective: *To evaluate visual acuity and keratometric outcomes before and after simultaneous superotemporal small incision cataract surgery (SICS) combined with inferior limbal conjunctival autograft transplantation (ILCAT) secured by autologous serum.*

Methods: *This prospective cohort study included 54 adults with concurrent grade 1 and grade 2 nasal and temporal pterygium and senile cataract. Visual acuity (UCVA and BCVA) and keratometry were assessed preoperatively and at Day 1, Week 1, and Week 6 postoperatively.*

Results: *The majority of patients (62.9%) were aged 50–65 years. Both UCVA and BCVA improved significantly at all postoperative visits ($p < 0.0001$). By Day 1, 98.1% achieved good BCVA ($\geq 6/18$). IOP remained stable ($p = 0.539$). K1 changed significantly ($p = 0.0001$) reflecting pterygium-induced traction release; K2 remained stable ($p = 0.433$).*

Conclusion: *Simultaneous superotemporal SICS with inferior ILCAT using autologous serum is a safe, effective, and cost-efficient protocol for concurrent nasal and temporal pterygium and senile cataract. Larger multicentre trials with recurrence data are warranted.*

Keywords: *pterygium excision; small incision cataract surgery; conjunctival autograft; visual acuity; keratometry; tropical ophthalmology; autologous serum*

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INTRODUCTION:

Pterygium is a fibrovascular proliferative disorder of the ocular surface, classically described as a wing-shaped triangular overgrowth of subconjunctival tissue encroaching onto the cornea through the medial and less commonly the lateral palpebral fissure.[1,2] Its pathogenesis is multifactorial, encompassing genetic predisposition, immune-mediated mechanisms, and sustained environmental insults. Among recognised aetiological factors — including hot and dry climatic conditions, wind, dust, advanced age, male sex, and outdoor occupational exposure ultraviolet (UV) radiation from sunlight remains the most consistently implicated agent.[1,3] UV-induced limbal stem cell injury is thought to trigger conjunctival epithelial invasion, subepithelial fibrosis, and ultimately corneal encroachment that disrupts Bowman's membrane and the overlying epithelium.[2,4]

India, by virtue of its tropical latitude and predominantly outdoor workforce, carries a disproportionately high burden of pterygium. Population-based surveys from South India record prevalence figures of 8–15%, with higher estimates in heavily sun-exposed communities.[5,6] The visual morbidity attributable to pterygium extends beyond simple visual axis obstruction: pterygium induces focal corneal flattening in the horizontal meridian, generating with-the-rule astigmatism in early stages that evolves into irregular and against-the-rule astigmatism as the lesion advances, and significantly increases corneal wavefront aberrations even before the visual axis is encroached.[7,8]

Senile cataract is an equally ubiquitous age-related cause of visual impairment in the Indian subcontinent, with reported prevalence of approximately 56% in South Indian comparative studies.[9,10] The same shared aetiological substrate cumulative UV radiation exposure predisposes to both conditions simultaneously, creating a clinically common scenario of coexistent pterygium and cataract in elderly patients in tropical regions.[11,12] Epidemiological data from the Blue Mountains Eye Study and subsequent longitudinal analyses have demonstrated a statistically significant association between pterygium and the five-year incidence of cataract, reinforcing the biological plausibility of their co-occurrence.[13,14]

When these conditions coexist, the surgeon faces a fundamental management dilemma: sequential or simultaneous surgery. Sequential pterygium excision followed by cataract surgery typically separated by four to twelve months offers the advantage of corneal stabilisation and more accurate intraocular lens (IOL) power calculation, since pterygium-induced corneal distortion can substantially alter keratometry readings and introduce significant prediction errors if biometry is performed preoperatively.[15,16]

However, the two-step approach imposes practical disadvantages on patients in resource-limited settings: prolonged visual disability, multiple hospital visits, and significant economic burden.[16,17] Simultaneous combined surgery has therefore been explored as a pragmatic single-session alternative. Gulani A et al were among the early proponents, reporting that 63% of 30 patients undergoing simultaneous surgery achieved visual recovery to 6/12 at six months, with mean with-the-rule and against-the-rule astigmatism of 1.3 D and 1.2 D respectively though using older intracapsular/extracapsular techniques with suture fixation.[17]

Manual small incision cataract surgery (SICS) with ILCAT secured by autologous serum represents a cost-effective combination suited to the Indian tertiary care context. Autologous serum achieves graft adherence equivalent to fibrin glue while eliminating allergic reactions, reducing postoperative graft inflammation, and avoiding the expense and theoretical disease-transmission risk of commercial fibrin glue preparations.[18,19] The choice of a superotemporal rather than superior SICS incision is also mechanistically important in this context: superior incisions induce approximately 1.28 D of against-the-rule surgically induced astigmatism, which, compounded with post-pterygium corneal changes, risks amplifying postoperative astigmatism and compromising final UCVA.[20,21] Despite this rationale, prospective data on this specific combination remain limited.

The present study was therefore designed to systematically evaluate visual acuity and keratometric outcomes before and after simultaneous superotemporal SICS with inferior ILCAT in patients with concurrent nasal pterygium and senile cataract at a South Indian tertiary centre.

AIM AND OBJECTIVES:

Aim:
To compare visual acuity before and after simultaneous small incision cataract surgery and pterygium excision with inferior limbal conjunctival autograft transplantation.

Objectives:
To evaluate visual acuity in patients with concurrent senile cataract and pterygium following the combined surgical procedure.
To serially assess visual acuity at postoperative Day 1, Week 1, and Week 6 after simultaneous SICS and ILCAT.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Ophthalmology, Navodaya Medical College Hospital & Research Centre, Raichur. Ethical approval was obtained from the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from all participants.

All adults presenting with concurrent cataract and grade 1 and grade 2 pterygium in the same eye during the study period were considered for inclusion. A minimum sample of 30 was planned by convenient non-probability sampling; 54 patients fulfilling eligibility criteria were enrolled.

Patients with concurrent grade 1 and grade 2 pterygium and senile immature or mature cataract in the same eye were included, provided they had normal ocular findings (clear cornea excluding pterygium, normal pupil, B-scan, lacrimal patency, and intraocular pressure) and controlled systemic conditions without diabetic retinopathy. Only nasal and temporal pterygium cases were considered. Patients with central corneal opacity involving the visual axis, glaucoma, active ocular infection, retinopathy, or double pterygium were excluded. Visual acuity was recorded using the Snellen chart. Anterior segment evaluation included slit-lamp biomicroscopy and direct ophthalmoscopy. Fundus examination was performed using Volk +78D/+90D lenses at the slit lamp and Volk +20D with indirect ophthalmoscopy. IOP was measured by Goldmann applanation tonometry. Keratometry (K1 and K2) was obtained with a Bausch and Lomb keratometer. Axial length was measured by A-scan ultrasonography (Appascan 2000) for IOL power calculation. Demographic data were collected by structured interview.

Surgical technique:

Preoperatively, moxifloxacin 0.5% drops were given four times daily for three days. On the day of surgery, the operative eye was dilated with tropicamide 0.8% and phenylephrine 5%; flurbiprofen 0.3 mg drops prevented intraoperative miosis.

Under peribulbar anaesthesia with povidone-iodine preparation, pterygium excision was performed first using Castroviejo forceps and Westcott scissors at the demarcation line, followed by corneal polishing with a crescent knife. An oversized inferior limbal conjunctival autograft (0.5–1 mm) was harvested after subconjunctival lignocaine 2% injection, rotated to orient the limbal margin over the excision site, and secured with autologous serum under cotton bud pressure for 2–3 minutes. The inferior donor site was selected to preserve superior conjunctiva for potential future glaucoma filtering surgery and to minimise patient discomfort.

Superotemporal SICS was then performed through a 6–7 mm incision (immature cataract) or 7–8 mm incision (mature cataract) positioned ~3 mm from the limbus. This incision was deliberately superotemporal rather than superior, as nasal pterygium induces with-the-rule astigmatism and a superior incision would compound this with against-the-rule surgically induced astigmatism, reducing final visual acuity. After creating a fornix-based conjunctival flap and scleral tunnel, haemostasis was achieved with bipolar diathermy. Following side-port creation, capsule staining with trypan blue, and continuous curvilinear capsulorrhexis, the nucleus was delivered by sandwich technique. After cortical aspiration, a rigid PMMA PCIOL of calculated power was implanted in the bag. Wound integrity was confirmed before hydration. Subconjunctival dexamethasone 0.25 ml and gentamicin 0.25 ml were injected at the incision site, distant from the graft.

Postoperative management:

All patients received antibiotic-steroid combination drops six times daily with weekly tapering, and moxifloxacin 0.5% ointment and hydroxypropylmethyl cellulose 2% ointment at bedtime for two weeks. Patients with anterior uveitis received hourly topical drops with close monitoring. Strict eye hygiene and avoidance of eye-rubbing were emphasised. Postoperative visual acuity was recorded at Day 1, Week 1, and Week 6.

Statistical analysis:

Data were entered and analysed using SPSS version 21. Visual acuity was categorised per WHO grading: Good (≥ 6/18), Average (6/18–6/60), and Poor (< 6/60). Paired sample t-tests compared preoperative and postoperative continuous parameters. $P < 0.05$ was considered statistically significant.

RESULTS:

Fifty-four patients were enrolled. The majority (62.9%) were in the 50–65 year age group, consistent with the expected peak age for concurrent senile cataract and pterygium (Table 1). Female patients constituted a slight majority (51.9%).

Table 1: Age and sex distribution of study participants

Age (Years)	Males n(%)	Females n(%)	Total n(%)
<50	8 (57.1)	6 (42.9)	14 (25.9)
50–65	15 (44.1)	19 (55.9)	34 (62.9)
>65	3 (50.0)	3 (50.0)	6 (11.2)
Total	**26 (48.1)**	**28 (51.9)**	**54 (100)**

Nuclear cataract was the most common type (33.3%), followed by cortical cataract (24.1%) and nuclear with cortical combination (20.4%) (Table 2). Pterygium is graded according to TAN’S CLASSIFICATION, T1(atrophic), T2(Intermediate) and T3(fleshy).T2 pterygium predominated (57.4%), followed by T3 (38.9%) and T1 (3.7%) (Table 3).

Table 2. Distribution of cataract type among study participants

S.No	Type of Cataract	Frequency(n=54)	Percentage (%)
1	Cortical	13	24.1

2	Cortical and Nuclear	2	3.7
3	Cortical and PSC	2	3.8
4	Nuclear	18	33.3
5	Nuclear and Cortical	11	20.4
6	Nuclear and PSC	3	5.6
7	Nuclear, Cortical and PSC	1	1.9
8	PSC	4	7.4

Table 3: Distribution of Pterygium type among study participants

S.No	Type of Pterygium	Frequency (n=54)	Percentage (%)
1	T1	2	3.7
2	T2	31	57.4
3	T3	21	38.9

Mean preoperative K1 and K2 were 44.7 ±1.2 D and 45.4 ±1.1 D respectively (Table 4). K1 showed a statistically significant change postoperatively (mean difference −0.65 D; t = −15.072; p = 0.0001), reflecting resolution of pterygium-induced corneal traction. K2 did not change significantly (mean difference 0.33 D; p = 0.433) (Tables 5, 6). Strong pre-to-postoperative correlations were noted for both K1 (r = 0.965; p = 0.0001) and K2 (r = 0.964; p = 0.0001).

Table 4: Keratometry values (Pre- and Postoperative)

Operative Status	K1 – Mean (SD) D	K2 – Mean (SD) D
Preoperative	44.7 (±1.2)	45.4 (±1.1)
Postoperative	45.4 (±1.1)	45.3 (±1.2)

Table 5: Comparison of K Values between pre- and postoperative periods

S.No	Parameter	Mean Difference	SE Mean	t Value	P Value
1	K1	−0.65	0.043	−15.072	0.0001*
2	K2	0.33	0.042	0.789	0.433
** Statistically significant (p < 0.05)*					

Table 6: Pearson correlation of pre- and postoperative keratometry

S.No	Comparison	Pearson r	P Value
1	Pre-op vs. Post-op (K1)	0.965	0.0001*
2	Pre-op vs. Post-op (K2)	0.964	0.0001*
** Statistically significant (p < 0.05)*			

Mean preoperative IOP was 15.6 ±2.8 mmHg. Serial postoperative values at Day 1 (15.4 ±2.4 mmHg), Week 1 (14.9 ±2.3 mmHg), and Week 6 (15.2 ±2.1 mmHg) remained within normal limits. Paired t-test showed no significant change (t = −0.619; p = 0.539) (Table 7).

Table 7: Intraocular Pressure(Pre- and Postoperative)

S.No	Operative Status	IOP Mean (SD) mmHg
1	Preoperative	15.6 (±2.8)
2	Postoperative – Day 1	15.4 (±2.4)
3	Postoperative – Week 1	14.9 (±2.3)

4	Postoperative – Week 6	15.2 (±2.1)
Paired t-test: T = −0.619; P = 0.539 (Not significant)		

Preoperatively, 88.9% of patients had poor UCVA (< 6/60) and none had good UCVA. By Day 1, 87% had achieved good UCVA with complete elimination of poor visual acuity. BCVA showed an even more dramatic improvement: preoperatively, 68.5% had poor BCVA and none had good BCVA; by Day 1, 98.1% had good BCVA. All differences were highly statistically significant (p = 0.0001). Full serial distribution is presented in Table 8.

Table 8: Comparison of Visual Acuity (UCVA and BCVA) Across Study Visits

Time Frame	Good n(%)	Average n(%)	Poor n(%)	P- value
UCVA (Uncorrected Visual Acuity)				
Preoperative	0 (0)	6 (11.1)	48 (88.9)	0.0001*
Postoperative – Day 1	47 (87.0)	7 (13.0)	0 (0)	
Postoperative – Week 1	49 (90.7)	0 (0)	0 (0)	
Postoperative – Week 6	47 (87.0)	0 (0)	0 (0)	
BCVA (Best-Corrected Visual Acuity)				
Preoperative	0 (0)	17 (31.5)	37 (68.5)	0.0001*
Postoperative – Day 1	53 (98.1)	1 (1.9)	0 (0)	
Postoperative – Week 1	49 (90.7)	0 (0)	0 (0)	
Postoperative – Week 6	47 (87.0)	0 (0)	0 (0)	
** Statistically significant (p < 0.05). WHO grading: Good ≥ 6/18; Average 6/18–6/60; Poor < 6/60.*				

DISCUSSION:

This study demonstrates that simultaneous superotemporal SICS with inferior limbal conjunctival autograft transplantation secured by autologous serum achieves excellent visual and keratometric outcomes in patients with concurrent nasal pterygium and senile cataract. The rapid and sustained improvement in both UCVA and BCVA, the significant K1 normalisation, stable IOP profile, and absence of major complications support this combination as a safe, effective, and contextually appropriate protocol for the South Indian tertiary care setting.

The predominance of patients in the 50–65 year age group (62.9%) and near-equal sex distribution in our cohort is consistent with patterns reported in comparable Indian series. Fatima et al., in a longitudinal study of 60 patients undergoing combined surgery at NMCH Raichur, similarly found 46.7% in the 51–60 year group.[22] Sharma et al. reported a mean age of 61.9 ±7.14 years in their phacoemulsification-based combined series.[23] The sequential series by Kalaiselvi G et al had a mean age of 59.80 ±6.71 years.[15] These comparable demographic profiles across studies reflect the convergent epidemiology of senile cataract and pterygium in tropical India, driven by the shared UV radiation aetiology.[11–14]

Nuclear cataract was the dominant subtype in our series (33.3%), consistent with the well-established predominance of nuclear sclerosis in Indian populations exposed to tropical UV radiation.[9,10] Sharma et al. similarly reported nuclear sclerosis grades 2 and 3 in all their patients.[23] T2 pterygium was the most common morphological type in our cohort (57.4%), reflecting a patient population presenting at an intermediate, surgically manageable stage precisely the profile for which combined surgery is most appropriate.

The visual recovery in our cohort was both rapid and substantial. By Day 1 postoperatively, 98.1% achieved good BCVA (≥ 6/18), with the proportion maintained at 87% at Week 6 after accounting for drop-outs. This represents a marked improvement over the earliest combined surgery data: Gulani A et al, who pioneered simultaneous pterygium and cataract surgery in India, reported that only 63% of 30 patients achieved 6/12 at six months using intracapsular/extracapsular techniques with suture fixation.[17] The dramatic improvement in outcomes in our series reflects the transition to modern SICS technique and the advantages of autologous serum-secured ILCAT.

Sharma et al. demonstrated BCVA improvement from 0.667 ±0.24 logMAR to 0.008 ±0.03 logMAR at one year (p < 0.01) using phacoemulsification with fibrin glue, reporting no intraoperative or postoperative complications in their 12-patient series.[23] Fatima et al., in their larger 60-patient longitudinal study, found that

33.3% achieved normal vision and 33.3% achieved BCVA 6/12–6/18 postoperatively, with complete resolution of the 6/60–3/60 preoperative group.[22] Our results are consistent with and extend these findings to a larger cohort using the SICS modality rather than phacoemulsification a clinically important distinction given the cost and skill-level advantages of SICS in tertiary Indian centres.

For the sequential approach, Kalaiselvi G et al achieved UDVA 6/9 or better in 85% and final BCVA 6/6 in all 20 patients at six weeks after the cataract step.[15] While sequential surgery has the advantage of post-pterygium corneal stabilisation allowing more precise IOL calculation, it imposes a cumulative follow-up burden and extended disability period. Our results with combined surgery at Week 6 are broadly comparable to the six-week post-cataract outcomes in the sequential series, suggesting that appropriate surgical planning particularly superotemporal incision selection and grade-based patient selection can yield equivalent visual outcomes in a single session.

The selective and statistically significant change in K1 ($p = 0.0001$) without corresponding K2 change ($p = 0.433$) reflects the meridional specificity of pterygium-induced corneal distortion. Nasal pterygium exerts traction specifically on the horizontal corneal meridian, flattening K1 and producing with-the-rule astigmatism; excision releases this traction, allowing K1 steepening toward its native value.[7,8] The strong pre-to-post correlations for both K1 and K2 ($r = 0.965$ and 0.964; both $p = 0.0001$) confirm that the native corneal curvature architecture was substantially preserved through the combined surgical procedure. Sharma et al. documented a significant postoperative increase in mean keratometry from 43.81 ±1.77 D to 44.19 ±1.76 D ($p < 0.05$), attributing this to corneal steepening after pterygium-induced flattening reversal a myopic shift they emphasised must be accounted for in IOL selection.[23] Their correlation between prediction errors and pterygium size ($r = -0.75$, $p < 0.05$) emphasises that larger lesions introduce greater refractive unpredictability. Similarly, Kalaiselvi G et al documented mean corneal astigmatism declining from 7.33 ±3.89 D preoperatively to 0.84 ± 0.68 D after sequential cataract surgery, with keratometry stabilising by one month post-pterygium excision.[15] Kamiya et al. reported that simultaneous surgery yielded only 48% of eyes within ±0.5 D of the targeted correction, further illustrating the refractive challenge of combined approaches.[24]

The grade-stratified findings of Fatima et al. add an important nuance: their combined surgery series achieved statistically significant astigmatic reduction only in early-stage pterygium (grades 1–2; $p = 0.023$), whereas grade 3–4 pterygium showed non-significant residual astigmatism ($p = 0.048$).[22] This is directly relevant to our cohort, in which T2 pterygium (predominantly grade 2) accounted for 57.4% of cases. The superior astigmatic and visual outcomes in our series likely partly reflect appropriate patient selection predominantly intermediate-grade pterygium for whom combined surgery's keratometric restoration is most complete and predictable.

The superotemporal incision selection deserves specific discussion. Since nasal pterygium induces with-the-rule astigmatism by flattening the horizontal meridian, a superior SICS incision known to produce approximately 1.28 D of against-the-rule SIA would compound the post-pterygium astigmatic shift and potentially degrade final UCVA.[19,18] The superotemporal approach used in our study consistently induces less against-the-rule astigmatism, and the excellent UCVA outcomes across our postoperative visits validate this incision strategy. Sharma et al. used superotemporal incisions for right eyes in their phacoemulsification series for the same rationale.[23] Kalaiselvi G et al used a temporal sclero-corneal tunnel for the same mechanistic reason in their sequential MSICS series.[15]

Intraocular pressure remained stable throughout the postoperative period ($t = -0.619$; $p = 0.539$). This finding is clinically important given the theoretical risks of both IOP elevation (from post-surgical inflammation, residual viscoelastic, or steroid-induced response) and IOP reduction (from cataract surgery alone) in the combined surgical context. The preservation of stable IOP across all four assessment points reflects the safety of the peribulbar anaesthesia technique, careful avoidance of graft site contamination by subconjunctival injections, and the use of autologous serum whose minimal inflammatory potential reduces the need for escalated topical steroid. Serial IOP monitoring is not reported in the reference series, making our data a useful addition to the safety profile literature for combined surgery.

Three graft fixation modalities have been evaluated for pterygium surgery: sutures, fibrin glue, and autologous blood/serum. Sharma et al. used commercially prepared fibrin glue (TISSEEL), demonstrating excellent outcomes and emphasising its role in reducing operative time, postoperative pain, and early rehabilitation.[23] A Cochrane review of fibrin glue versus sutures for conjunctival autografting in primary pterygium surgery confirmed lower recurrence rates and shorter operative times with fibrin glue.[25] Kalaiselvi G et al employed autologous blood in their sequential series, reporting zero graft loss, dehiscence, or recurrence, concluding that autologous blood is a natural, cost-free alternative that avoids the transmissible disease risk and expense of fibrin glue.[15] In the present study, autologous serum was selected as the fixation medium. Published evidence indicates that autologous serum achieves equivalent graft adherence to fibrin glue while significantly reducing postoperative graft inflammation and eliminating the risk of allergic complication.[18,19] This choice is consistent with the cost-effectiveness principles emphasised in Indian tertiary care ophthalmology, where fibrin glue kits represent a non-trivial per-procedure cost. Importantly, the inferior graft harvest site preserves the superior conjunctiva maintaining its availability for future trabeculectomy if glaucoma subsequently develops which is a clinically meaningful long-term consideration.[15]

The debate between simultaneous and sequential management remains contextually nuanced. Sequential surgery affords superior IOL predictability, as clearly demonstrated by the significant post-excision IOL power recalculation documented by Kalaiselvi G et al (23.65 ±2.81 D vs. 21.65 ±2.38 D, $p < 0.001$).[15] For patients with advanced-grade (3–4) pterygium, in whom Fatima et al. found non-significant astigmatic reduction after combined surgery, sequential management likely offers superior refractive outcomes.[22] Fatima et al. explicitly advocated sequential surgery for grade 3–4 cases: pterygium excision with conjunctival autograft followed by cataract surgery one month later.[22] For patients with early- to intermediate-grade pterygium (grades 1–2, T2 morphology) as predominantly seen in our cohort combined surgery offers: single-session visual rehabilitation, reduced hospital visits and costs, and equivalent refractive and visual outcomes. Sharma et al. and Fatima et al. both independently concluded that combined surgery is safe and provides predictable outcomes when pterygium size is not large.[19,20] Gulani A et al, who established the foundation for simultaneous surgery in India, advocated it on both visual and economic grounds.[17] Our data, representing the largest Indian prospective series using SICS with inferior ILCAT and autologous serum, provide further support for combined surgery as a standard protocol in this well-defined patient subgroup.

Limitations:

Single-centre prospective design with a small sample size (n = 54), limiting generalisability

Short follow-up duration (6 weeks), preventing assessment of pterygium recurrence (key long-term outcome)

Lack of a sequential surgery comparator arm, limiting direct efficacy comparisons

Absence of higher-order corneal aberration and topographic wavefront analysis, reducing detailed optical assessment

Need for future multicentre prospective trials with longer follow-up, recurrence data, standardised vector astigmatism analysis, and comparative arms (sequential surgery and phacoemulsification)

CONCLUSION:

Simultaneous superotemporal small incision cataract surgery with inferior limbal conjunctival autograft transplantation secured by autologous serum represents a safe, effective, and cost-efficient protocol for the single-session management of concurrent nasal and temporal pterygium and senile cataract. The combined approach achieves excellent immediate visual recovery, corrects pterygium-induced keratometric distortion, maintains stable intraocular pressure, and avoids the socioeconomic and practical burdens associated with staged procedures. These outcomes are most predictable in patients with early- to intermediate-grade pterygium (T2, grades 1–2), where pterygium-induced corneal distortion is still reversible and IOL power prediction errors are minimised. For advanced-grade (grade 3–4) pterygium, a sequential approach with post-pterygium corneal stabilisation should be preferred. These findings support superotemporal SICS with inferior ILCAT as a standard protocol in resource-appropriate tertiary settings, pending validation through larger multicentre prospective trials with standardised astigmatism analysis, recurrence monitoring, and direct sequential surgery comparison.

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