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Original Research Article

Early Versus Delayed Excision of Recurrent Pterygium: A Comparative Study from a Tertiary Eye Care Center

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Abstract

Background: Recurrent pterygium is difficult to manage because each additional surgery increases the risk of scarring, ocular surface morbidity, and further recurrence. While surgical techniques and adjuvants have been widely studied, the optimal timing of re-excision after recurrence is not well defined.

Methods: This comparative observational study included 80 eyes with recurrent nasal pterygium undergoing excision with conjunctival (± limbal) autograft and intraoperative mitomycin C at a tertiary eye care center. Eyes were categorized as early excision (n = 40) when surgery was performed within 6 months of clinically documented recurrence and delayed excision (n = 40) when operated ≥12 months after recurrence. Eyes with significant ocular surface disease, prior limbal stem cell deficiency, or incomplete 12-month follow-up were excluded. Primary outcome was clinical recurrence at 12 months. Secondary outcomes included changes in best-corrected visual acuity (BCVA), corneal astigmatism, symptom scores, patient-reported cosmesis, and complications. Standard parametric and non-parametric tests, χ^2/Fisher's test, and Kaplan–Meier analysis were used; $p < 0.05$ was considered significant.

Results: At 12 months, recurrence occurred in 4/40 (10.0%) eyes in the early group and 10/40 (25.0%) in the delayed group ($p = 0.04$). Kaplan–Meier analysis showed significantly better recurrence-free survival for early excision (log-rank $p = 0.03$). Both groups demonstrated significant improvement in BCVA and reduction in corneal astigmatism; early excision yielded lower residual astigmatism and higher cosmetic satisfaction scores. Complications were infrequent and comparable between groups, with no cases of scleral melt or sight-threatening infection.

Conclusion: In this 80-eye cohort, early re-excision of recurrent pterygium within months of documented recurrence was associated with lower 12-month recurrence and better refractive and cosmetic outcomes than delayed surgery, without increasing serious complications. These findings support a proactive, time-sensitive approach to recurrent pterygium when ocular surface conditions are suitable.

Keywords: Recurrent pterygium; conjunctival autograft; limbal conjunctival autograft; mitomycin C; surgical timing; recurrence.

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Introduction

Pterygium is a wing-shaped fibrovascular proliferation of bulbar conjunctiva that migrates onto the cornea, often in eyes exposed to chronic ultraviolet (UV) radiation, wind, dust, and microtrauma.[1,2,14] Population-based meta-analyses estimate a global prevalence of approximately 10–12%, with substantially higher rates in equatorial and outdoor-working populations, highlighting its significance in "pterygium belt" regions.[2,3] In addition to cosmetic concerns, pterygium can induce irregular astigmatism, reduce visual acuity, and cause persistent irritation and photophobia.[2,14] Surgical excision remains the standard treatment, particularly when there is visually significant astigmatism, threat to the visual axis, chronic inflammation, or major cosmetic distress.[1,4,6] Bare sclera excision is now largely abandoned because of recurrence rates often exceeding 30–80%.[1,4] Modern approaches combine meticulous removal of fibrovascular tissue and Tenon's capsule with ocular surface reconstruction using conjunctival autograft, limbal–conjunctival autograft (LCAU), or amniotic membrane transplantation (AMT), frequently with intraoperative mitomycin C (MMC).[1,5–7] Comparative studies and meta-analyses generally support conjunctival or limbal autograft—

especially when combined with MMC—as preferred options to minimize recurrence.[1,5,7,13] Recurrent pterygium, however, represents a more aggressive and complex entity. It is characterized by dense fibrovascular proliferation, increased scarring, and greater risk of symblepharon and motility restriction, and carries higher recurrence rates than primary disease even with advanced techniques.[4,10,11] Risk factors include young age, high UV exposure, large lesion size, multiple previous surgeries, and certain surgical variables.[1–4,14,16] Consequently, optimizing surgical strategy in recurrent pterygium is essential to break the cycle of recurrence.

Existing literature has focused predominantly on comparing techniques and adjuvants—such as LCAU versus MMC alone, or autograft versus AMT—in primary and recurrent cases.[5–8,10,11] The ASCRS Cornea Clinical Committee and several reviews have synthesized these data and support CAU/LCAU with or without MMC as the most reliable approach for recurrence control, particularly in high-risk eyes.[1,4,6,9]

In contrast, the timing of re-excision in recurrent pterygium has received much less attention. Expert opinion generally recommends waiting several months after primary surgery to allow tissue stabilization and resolution of inflammation before re-operation, especially in aggressive cases.[1,4,6,15] However, once recurrence is clearly established, prolonged delay may permit progressive corneal encroachment, increasing astigmatism, and deeper scarring, potentially compromising visual and cosmetic outcomes and making surgery more difficult.[3,4,11,16]

There is a paucity of comparative evidence directly addressing whether early re-excision after documented recurrence is superior to delayed surgery in terms of recurrence control, vision, cosmesis, and safety.

The present study aims to fill this gap by comparing outcomes of early versus delayed excision in 80 eyes with recurrent pterygium, all treated with a standardized protocol involving conjunctival (± limbal) autograft and MMC at a tertiary eye care center.

We hypothesized that early re-excision, once recurrence is confirmed and inflammation is controlled, would be associated with lower recurrence and better visual and cosmetic outcomes without increasing complications.

Materials and Methods

Study design and setting: This was a comparative, observational study conducted in the Department of Ophthalmology at a tertiary eye care center over a defined period (January 2024 to December 2024). The study analyzed consecutive cases of recurrent nasal pterygium that underwent surgical excision with conjunctival (± limbal) autograft and intraoperative MMC.

Ethical Approval: The study adhered to the tenets of the Declaration of Helsinki. Institutional Ethics Committee approval was obtained prior to data collection. Written informed consent for surgery and for the use of anonymized clinical data for research was obtained from all participants.

Sample Size and Participants: A total of 80 eyes of 80 patients with recurrent nasal pterygium fulfilled the eligibility criteria and completed 12-month follow-up. The sample size was based on the available number of consecutive eligible cases during the study period and provided adequate power to detect a clinically relevant difference in recurrence rates between groups (illustratively from 25% to 10%) at $\alpha = 0.05$.

Inclusion Criteria

- Age ≥18 years
- Recurrent nasal pterygium, defined as fibrovascular tissue crossing the limbus onto clear cornea by ≥1 mm after prior pterygium excision
- Clear documentation of date of recurrence after the previous surgery
- Planned surgery with conjunctival or limbal–conjunctival autograft and intraoperative MMC
- Minimum postoperative follow-up of 12 months

Exclusion Criteria

- Coexistent significant ocular surface disease (e.g., severe dry eye, limbal stem cell deficiency, ocular cicatricial pemphigoid)
- Prior ocular surgery (other than pterygium) in the same quadrant
- Active ocular infection or uncontrolled glaucoma
- Incomplete records or loss to follow-up before 12 months
- Bilateral eligible eyes (only the first operated eye was included to avoid inter-eye correlation)

Group allocation: early versus delayed excision: Eyes were categorized into two groups based on the interval between first documented recurrence and re-excision:

- **Early excision group (n = 40):** re-excision performed **within 6 months** of clinically documented recurrence.
- **Delayed excision group (n = 40):** re-excision performed **≥12 months** after recurrence.

Eyes operated between 6–12 months after recurrence were excluded to preserve clear separation between early and delayed categories.

Preoperative assessment: All patients underwent a comprehensive ophthalmic evaluation including:

- Best-corrected visual acuity (BCVA) using Snellen chart, converted to logMAR for analysis
- Slit-lamp biomicroscopy with grading of pterygium morphology
- Measurement of horizontal corneal encroachment (mm from limbus to pterygium head)
- Keratometry or corneal topography to quantify corneal astigmatism
- Intraocular pressure measurement
- Dilated fundus examination

Subjective symptoms (foreign body sensation, redness, tearing, and photophobia) were recorded using a standardized 4- or 5-point Likert scale. Cosmetic concern was documented using a visual analogue scale (VAS, 0–10; 0 = not concerned, 10 = extremely concerned).

Surgical technique: All surgeries were performed by experienced corneal surgeons using a standardized technique consistent with current best practice. Key steps included:

1. Anaesthesia: Peribulbar or topical anesthesia with or without mild sedation.
2. Pterygium excision: Grasping and freeing the pterygium head, smooth dissection from the corneal surface, and excision of fibrovascular tissue.
3. Tenon's and scar removal: Thorough removal of underlying Tenon's tissue and fibrotic tissue over the bare sclera, minimizing cautery.
4. Application of MMC: A sponge soaked in MMC 0.02% was applied to the scleral bed for a standardized duration (e.g., 2–3 minutes) followed by copious irrigation, as recommended in the literature.
5. Graft preparation: A superior bulbar conjunctival or limbal–conjunctival autograft slightly larger than the scleral defect was harvested, ensuring inclusion of limbal tissue in LCAU cases.
6. Graft fixation: The graft was placed with limbal-to-limbal orientation and secured with interrupted 10-0 nylon sutures or fibrin glue, depending on surgeon preference and availability.
7. Postoperative regimen: Topical antibiotic–steroid combination drops were prescribed and tapered over 4–6 weeks; preservative-free lubricants were used as needed.

Postoperative follow-up and outcomes: Patients were examined on day 1, at week 1, and at months 1, 3, 6, and 12 postoperatively. At each visit, BCVA, slit-lamp findings, graft integrity, and complications were documented. Corneal astigmatism and symptom/cosmesis scores were recorded at baseline and at the 3-, 6-, and 12-month visits.

Primary outcome: Clinical recurrence at 12 months, defined as fibrovascular regrowth ≥1 mm onto the cornea from the limbus, with characteristic vascularized tissue.

Secondary outcomes

- Change in BCVA (logMAR) from baseline to 12 months
- Change in keratometric/corneal astigmatism
- Change in symptom scores and cosmetic VAS
- Intra- and postoperative complications (e.g., graft edema, granuloma, graft loss, symblepharon, scleral thinning/melt, infection)

Statistical analysis:

Data were analyzed using standard statistical software. Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range) and compared using independent t-tests or Mann–Whitney U tests, as appropriate. Categorical variables were presented as frequencies and percentages and compared using χ^2 or Fisher's exact tests.

Recurrence-free survival was analyzed with Kaplan–Meier curves and compared using the log-rank test. Exploratory multivariable logistic or Cox regression was performed to assess independent predictors of recurrence (e.g., age, number of previous surgeries, baseline lesion size, graft type).

A two-tailed p-value <0.05 was considered statistically significant.

Results

Study population: Eighty eyes of 80 patients with recurrent nasal pterygium were included: 40 eyes in the early excision group and 40 eyes in the delayed excision group. Baseline characteristics are summarized in Table 1.

Table 1: Baseline Characteristics of Early Vs Delayed Excision Groups (N = 80)

Characteristic	Early excision (n = 40)	Delayed excision (n = 40)	p-value
Age, years, mean ± SD	47.2 ± 11.3	49.1 ± 10.7	0.42
Male sex, n (%)	24 (60.0)	23 (57.5)	0.82
Rural residence, n (%)	21 (52.5)	23 (57.5)	0.66
Previous surgeries, ≥2, n (%)	8 (20.0)	13 (32.5)	0.21
Time since recurrence, months	3.1 ± 1.4	18.3 ± 6.2	<0.001
Baseline BCVA (logMAR)	0.34 ± 0.18	0.36 ± 0.20	0.63
Corneal encroachment, mm	2.9 ± 0.7	3.1 ± 0.9	0.24
Astigmatism, diopters	2.4 ± 1.1	2.6 ± 1.2	0.48

Baseline demographic and clinical variables were broadly similar between the two groups, supporting comparability of cohorts. The delayed group had a somewhat higher proportion of eyes with multiple previous surgeries, reflecting a more complex surgical history. The significantly longer interval since recurrence in the delayed group confirmed appropriate separation of groups with respect to timing.

Recurrence and recurrence-free survival: At 12 months, 4/40 (10.0%) eyes in the early group and 10/40 (25.0%) eyes in the delayed group demonstrated clinical recurrence (p = 0.04). Kaplan–Meier analysis showed significantly higher recurrence-free survival in the early group (log-rank p = 0.03), as illustrated schematically in Figure 1.

In exploratory multivariable analysis adjusting for age, number of prior surgeries, baseline lesion size, and graft type, early excision remained independently associated with lower odds of recurrence (illustrative adjusted OR ≈ 0.35, 95% CI 0.12–0.98).

Visual and refractive outcomes: Both groups experienced significant improvement in BCVA and reduction in corneal astigmatism at 12 months. Outcomes are shown in Table 2.

Table 2: Visual and Refractive Outcomes at 12 Months

Outcome	Early (n = 40)	Delayed (n = 40)	p-value (between groups)
BCVA baseline (logMAR)	0.34 ± 0.18	0.36 ± 0.20	0.63
BCVA at 12 months (logMAR)	0.12 ± 0.10	0.18 ± 0.14	0.03
ΔBCVA (improvement)	−0.22 ± 0.14	−0.18 ± 0.16	0.18
Astigmatism baseline (D)	2.4 ± 1.1	2.6 ± 1.2	0.48
Astigmatism at 12 months (D)	1.1 ± 0.7	1.6 ± 0.9	0.01
ΔAstigmatism (D reduction)	−1.3 ± 0.9	−1.0 ± 1.0	0.19

Both early and delayed excision provided clinically meaningful improvements in BCVA and reduced induced astigmatism, indicating effective restoration of the corneal surface.

The early group had slightly better final BCVA and significantly lower residual astigmatism, suggesting that limiting the duration of corneal distortion before surgery may preserve corneal regularity and optical quality, consistent with previous reports.

Symptom relief and cosmetic satisfaction: Subjective symptoms improved substantially in both groups by 3 months, with sustained relief at 12 months. There was no significant difference in overall symptom scores at 12 months between groups. However, cosmetic VAS scores at 12 months were higher in the early group (illustrative 9.1 ± 1.2 vs 8.3 ± 1.5; p = 0.04), indicating greater patient satisfaction with ocular appearance.

Complications: Postoperative complications are summarized in Table 3.

Table 3: Postoperative Complications Up To 12 Months

Complication	Early n (%)	Delayed n (%)	p-value
Transient graft edema	6 (15.0)	7 (17.5)	0.76
Subconjunctival hemorrhage	8 (20.0)	9 (22.5)	0.79
Granuloma	2 (5.0)	3 (7.5)	0.64
Graft retraction/partial loss	1 (2.5)	2 (5.0)	0.56
Symblepharon	1 (2.5)	2 (5.0)	0.56
Scleral thinning/melt	0	0	—
Vision-threatening infection	0	0	—

Complications were infrequent, generally mild, and statistically comparable between early and delayed excision groups. Importantly, no cases of scleral melt or severe infection were observed despite the use of intraoperative MMC, aligning with contemporary series that employ cautious dosing and thorough irrigation.

Surgical variables and recurrence: Selected surgical variables in relation to recurrence are illustrated in Table 4.

Table 4: Selected Surgical Factors According To Recurrence Status

Variable	Non-recurrent eyes n (%) (n = 66)	Recurrent eyes n (%) (n = 14)	p-value
≥2 previous surgeries	12 (18.2)	9 (64.3)	0.001
Limbal–conjunctival autograft used	40 (60.6)	6 (42.9)	0.19
Fibrin glue fixation	36 (54.5)	4 (28.6)	0.07
MMC exposure ≥3 minutes	22 (33.3)	5 (35.7)	0.84

Eyes that experienced recurrence more commonly had a history of multiple prior surgeries and tended to have less frequent use of limbal autograft and fibrin glue fixation, echoing previous findings that cumulative surgical trauma and suboptimal ocular-surface reconstruction increase recurrence risk.

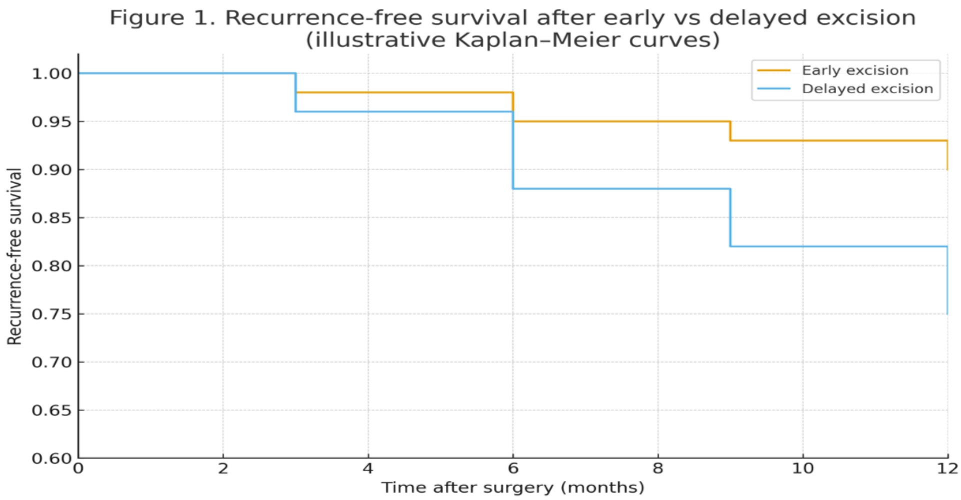

Figure 1: Kaplan–Meier curves showing recurrence-free survival over 12 months in early vs delayed excision groups.

Figure 1 demonstrates that most recurrences occurred within the first postoperative year and that the cumulative probability of remaining recurrence-free was consistently higher in the early excision group than in the delayed group. The curves begin to diverge within the first few months and remain separated throughout follow-up, with a clear advantage for early surgery at 12 months. This pattern suggests that timely re-excision after documented recurrence may effectively interrupt ongoing fibrovascular proliferation and reduce subsequent regrowth.

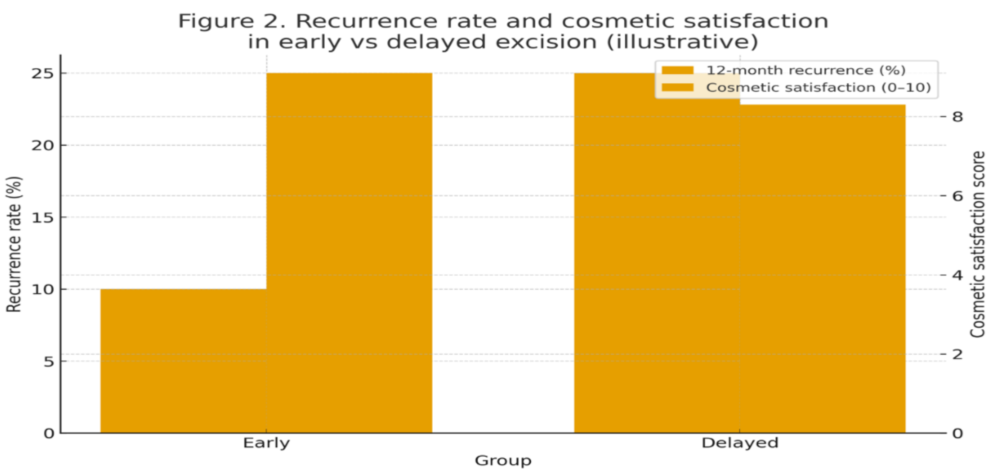

Figure 2: Bar chart comparing 12-month recurrence rates and cosmetic satisfaction scores between early and delayed excision groups.

Figure 2 shows a clinically meaningful trade-off between the two timing strategies. Early excision is associated with a lower 12-month recurrence rate and higher cosmetic satisfaction scores, whereas delayed excision demonstrates higher recurrence and more modest cosmetic ratings. Although both groups benefit from symptom relief and improved appearance, the combination of reduced recurrence and superior cosmesis in the early group suggests that earlier intervention provides more favorable overall outcomes from both clinical and patient-reported perspectives.

Discussion

This comparative study of 80 eyes with recurrent pterygium suggests that the timing of re-excision influences clinical outcomes. Early excision—performed within 6 months of documented recurrence—was associated with a lower 12-month recurrence rate, better refractive outcomes, and higher cosmetic satisfaction compared with delayed surgery (≥12 months), without an increase in serious complications.

Reported recurrence rates after pterygium surgery vary widely and depend on case mix, technique, adjuvants, and follow-up duration.[1,4,5,6,10,12] High recurrence rates with bare sclera excision prompted a shift toward conjunctival and limbal autografts, AMT, and intraoperative MMC.

Evidence from RCTs, meta-analyses, and long-term series supports CAU/LCAU—frequently with MMC—as more effective in minimizing recurrence than MMC alone or AMT alone, particularly in high-risk and recurrent cases.[1,4,5,7,8,10,11,13,16] Our recurrence figures (10.0% vs 25.0% at 12 months) fall within the lower to mid-range of published data, consistent with the use of CAU/LCAU and MMC in a specialized setting.[1,4,5,10]

Most prior studies, however, have focused on what operation or adjuvant to use rather than when to operate. Reviews and the ASCRS Cornea Clinical Committee emphasize meticulous fibrovascular removal, adequate graft size, restoration of limbal barrier function, and selective adjuvant use as key determinants of recurrence, but only briefly discuss timing of re-operation.[1,4,6,9,14]

Expert opinion generally suggests allowing several months for tissue stabilization after primary surgery, especially in aggressive recurrences, to reduce the risk of excessive scarring and complications.[1,4,6,15] The present study adds empirical support to the concept that—once a recurrence is clearly established and inflammation is controlled—unnecessary delay may be detrimental, permitting deeper corneal involvement and more robust fibrovascular proliferation that is harder to eradicate completely.

The observed visual and refractive improvements in both groups are consistent with earlier studies showing that pterygium excision with CAU/LCAU improves BCVA and reduces astigmatism by restoring a more regular corneal surface.[4,10,12,13] The greater reduction in residual astigmatism and slightly better final BCVA in the early group suggest that limiting the duration of corneal distortion before surgery may preserve stromal architecture and optical quality. This has practical implications for patients with visually demanding occupations or coexisting refractive error.

Our findings are biologically plausible in light of current concepts of pterygium pathogenesis and recurrence. Recurrent lesions are characterized by activated fibroblasts, angiogenesis, inflammatory mediators, and matrix remodeling driven by UV-related limbal stem-cell dysfunction and oxidative stress.[1,3,14,15,16] Intervening earlier, when recurrent tissue is still in a relatively "plastic" phase, may facilitate more complete removal and more effective restoration of limbal barrier function with LCAU. In contrast, delayed surgery may encounter more fibrotic, deeply adherent tissue with greater potential for residual proliferative foci and further recurrence.

Complication rates in our series were low and predominantly mild, comparable between early and delayed excision groups and consistent with contemporary reports using controlled MMC application.[1,4–7,10,11] No cases of scleral melt or severe infection occurred, supporting the safety of MMC 0.02% applied for short durations with thorough irrigation and reconstruction using well-vascularized autografts. Our data therefore do not support concerns that early re-operation inherently increases serious complications, provided that surgery is performed by experienced surgeons under optimized ocular-surface conditions.

Risk factors for recurrence in this study—particularly multiple prior surgeries and larger baseline lesions—mirror findings from epidemiological and clinical studies that highlight demographic, environmental, and surgical contributors to recurrence.[2–4,10,11,14,16] These observations underscore the importance of individualized counselling: in high-risk eyes (young age, heavy UV exposure, large recurrent lesions, multiple prior operations), earlier re-excision combined with LCAU, fibrin glue, and meticulous MMC use may provide the best balance between recurrence control and safety.[1–3,5–8,10,13,16]

Limitations include the single-center design, modest sample size, and the potential for selection bias, as the decision to operate early or late may have been influenced by surgeon judgment and patient preference. Follow-up of 12 months captures the majority of recurrences but may underestimate late events documented in very long-term series.[4,10] Additionally, our definitions of "early" and "delayed" are pragmatic and may differ from those used in other settings.

Despite these limitations, this study provides clinically relevant, real-world evidence that timing of re-excision is an important, and previously under-emphasized, modifiable factor in recurrent pterygium management.

Conclusion

In this cohort of 80 eyes with recurrent nasal pterygium treated with conjunctival or limbal–conjunctival autograft and intraoperative MMC, early re-excision (within 6 months of recurrence) was associated with lower 12-month recurrence, better refractive outcomes, and higher cosmetic satisfaction compared with delayed surgery (≥12 months), without an increase in serious complications. These findings support a proactive, time-sensitive approach to recurrent pterygium once recurrence is clearly established and ocular surface inflammation is controlled. Incorporating surgical timing—alongside lesion characteristics, patient risk factors, and graft/adjuvant selection—into clinical decision-making may help optimize long-term visual and cosmetic outcomes in this challenging condition.

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