

# Different therapeutic preferences for recurrent pterygia. Questionnaire in recurrent pterygia

Diferentes preferências terapêuticas para pterígios recorrentes.  
Questionário sobre pterígios recorrentes

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## ABSTRACT

**Objective:** To assess ophthalmologists' preferred techniques and adjuvant treatments for recurrent pterygium.

**Methods:** An observational study in which a questionnaire was administered to ophthalmologists who regularly performed surgeries for recurrent pterygium.

**Results:** Most surgeons did not use antiangiogenic therapy but preferred postoperative corticosteroids for one month. Symblepharon lenses were used only when available. The surgeons removed the pterygium head, including the conjunctiva and Tenon capsule, without invading the caruncle or base, preferring to remove the body first, followed by the head, with intermediate Tenon capsule resection. In cases where an autologous conjunctival graft was not possible, simple closure was preferred. Commercial fibrin glue was commonly used, with no specific adjuvant therapies postoperatively. Surgeons with over ten years of experience preferred removing the body and head first, using more mitomycin postoperatively, and favoring any available graft, while those with less experience preferred delaminating and using more sutures. There was greater agreement between the techniques chosen by experienced surgeons and those reported as most effective in the literature.

**Conclusion:** Surgical expertise and experience are pivotal in determining the approach for recurrent pterygium, particularly the number of surgeries needed. Preferred techniques included fibrin glue, intermediate Tenon capsule resection, mitomycin-C, and postoperative corticosteroids.

## RESUMO

**Objetivo:** Avaliar as técnicas e os tratamentos adjuvantes preferidos por oftalmologistas para pterígio recidivante.

**Métodos:** Estudo observacional em que um questionário foi aplicado a oftalmologistas que realizavam regularmente cirurgias para pterígio recidivante.

**Resultados:** A maioria dos cirurgiões não utilizou terapia antiangiogênica, mas preferiu corticosteróides pós-operatórios por 1 mês. Lentes de simbléfaro foram usadas apenas quando disponíveis. Os cirurgiões removeram a cabeça do pterígio, incluindo a conjuntiva e a cápsula de Tenon, sem invadir a carúncula ou a base, preferindo remover primeiramente o corpo, seguido da cabeça, com ressecção intermediária da cápsula de Tenon. Nos casos em que um enxerto conjuntival autólogo não era possível, optou-se pelo fechamento simples. Cola de fibrina comercial foi amplamente utilizada, sem terapias adjuvantes específicas no pós-operatório. Cirurgiões com mais de 10 anos de experiência preferiram remover primeiro o corpo e a cabeça, utilizando mais mitomicina no pós-operatório e favorecendo qualquer enxerto disponível, enquanto os menos experientes preferiram a delaminação e o uso de mais suturas. Houve maior concordância entre as técnicas escolhidas por cirurgiões experientes e aquelas relatadas como mais eficazes na literatura.

**Conclusão:** A experiência cirúrgica é crucial para determinar a abordagem para pterígio recidivante, particularmente o número de cirurgias necessárias. Técnicas preferidas incluíram cola de fibrina, ressecção intermediária da cápsula de Tenon, mitomicina C e corticosteróides pós-operatórios.

## INTRODUCTION

Pterygium is a common eye condition involving fibrovascular tissue growth from the conjunctiva, potentially extending over the cornea. This condition is related to genetic predisposition and exposure to environmental factors, primarily UV light and chronic microtraumas on the ocular surface, such as those caused by pollution and other irritants. It is more common in men and prevalent in countries near the equator. The prevalence of this condition increases with age, especially among smokers, individuals who work outdoors, and those with darker skin.<sup>(1-3)</sup>

The most effective and “gold standard” treatment for primary pterygium is pterygium excision with autologous conjunctival graft (ACG) due to its low recurrence rate, satisfactory aesthetic results, and low complication rates. Other techniques, such as simple pterygium excision, amniotic membrane grafts (AMG), bare sclera technique, and AMG, are associated with higher recurrence rates.<sup>(1-4)</sup>

Various analyses and literature reviews indicate that the bare sclera technique has a recurrence rate ranging from 27 to 88%. When mitomycin is applied with the bare sclera technique, the recurrence rate ranges from 3 to 40%. However, when an ACG is used, the recurrence rate is 0 to 15%. Finally, AMG has a 6 to 41% recurrence rate.<sup>(4-10)</sup>

Alternative adjuvant therapies for pterygium surgery include beta-irradiation, thiotepa, mitomycin-C (MMC), 5-fluorouracil (5-FU), cyclosporine, and collagen implants as substitutes for conjunctiva and the amniotic membrane (AM).<sup>(1-6)</sup>

Our research found little agreement among experts on the best adjuvant techniques and therapies for treating recurrent pterygium. We used questionnaires to gather information about preferred adjuvant treatments and techniques in such cases.

Our objective was to assess ophthalmologists' preferred techniques and adjuvant treatments for recurrent pterygium.

## METHODS

### Study design

This observational study used questionnaires to examine the treatment preferences of ophthalmologists in managing recurrent pterygium.

The questionnaire was developed by three ophthalmologists who were specialists in the anterior segment and familiar with treating recurrent pterygia. It included

questions regarding the technical characteristics of the participating physicians, their preferences for surgical techniques, treatment options during the postoperative period, and adjuvant therapies. We selected ophthalmologists who frequently performed surgeries for recurrent pterygium and did not exclude any ophthalmologist from the study. The project was submitted to the Research Ethics Committee to comply with the guidelines and norms of Resolution 466/12 of the National Health Council, the regulatory agency for research involving human subjects. This study was approved by the Ethics in Health Committee of the Santo Amaro University, registered under number CAAE: 75813623.4.0000.0081. The final questionnaire (Supplement 1) was sent to participating ophthalmologists via a Google Forms link.

### Statistical analysis

The responses collected through Google Forms were organized into tables and graphs. For statistical analysis, Microsoft Excel 2017 software for Windows was used. Descriptive analysis was presented in percentages. The normality of the sample was determined using the Shapiro–Wilk test and parametric tests such as the Student's T-test and Z-test for two proportions were used. A p-value  $\leq 0.05$  was considered significant.

## RESULTS

The questionnaire responses are shown in table 1. Significant differences were observed and are shown in tables 2 and 3 when the answers were categorized based on years of surgical experience or the number of pterygium surgeries performed annually. However, no significant differences were found between the responses of surgeons who performed ten to one hundred surgeries yearly (10c-) and those who performed > 100 surgeries yearly (10c+).

**Table 1.** Analysis of the most prevalent responses for each questionnaire item

	n (%)	p-value
Prefered technique		
Conjunctival graft, if possible	89 (89)	Ref.
P.E.R.F.E.C.T.	2 (2)	<0.001
Bare sclera	2 (2)	<0.001
Amniotic membrane	2 (2)	<0.001
Rotational flap	3 (3)	<0.001
Others	2 (2)	<0.001
Slet or similar	0	<0.001
Adjuvant therapies: anti-VGF		
Do not use	93 (93)	Ref.
anti-VGF pre-operative	1 (1)	<0.001
anti-VGF intra-operative	5 (5)	<0.001
anti-VGF pos-operative	1 (1)	<0.001

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	n (%)	p-value
<b>Intraoperative</b>		
5- fluorouracil intra-operative	5 (5)	<0.001
symblepharon lens in symblepharon cases	24 (24)	<0.001
corticosteroid injection	12 (12)	<0.001
always symblepharon lens	1 (1)	<0.001
None of the above	50 (50)	Ref.
Nothing	8 (8)	<0.001
<b>Pterygium removal</b>		
Remove the body first and then the head	34 (34)	Ref.
Remove the head first and then the body	19 (19)	0.016
Pullout	24 (24)	0.119
Delamination	23 (23)	0.085
None of the above	0	<0.001
<b>Surgically removed tissue</b>		
Resection of the head and conjunctiva with tenon removal	85 (85)	Ref.
Minimal resection of the head and conjunctiva	4 (4)	<0.001
Extensive resection up to the caruncle	1 (1)	<0.001
None of the above	10 (10)	<0.001
<b>Resected tenon tissue</b>		
Minimal	9 (9)	<0.001
Intermediate	50 (50)	Ref.
Extensive	41 (41)	0.201
<b>When proper conjunctival graft is not possible</b>		
Minimum conjunctival graft	10 (10)	<0.001
amniotic membrane	29 (29)	0.178
Limbal cells	6 (6)	<0.001
Bare sclera	7 (7)	<0.001
Simple conjunctival closure	38 (38)	Ref.
Labial mucosa	8 (8)	<0.001
Do not use conjunctival graft	2 (2)	<0.001
None of the above	0	<0.001
<b>Graft adhesion</b>		
Interrupted Vicryl® sutures	5 (5)	<0.001
Interrupted nylon sutures	18 (18)	<0.001
Fibrin glue	64 (64)	Ref.
Autologous fibrin glue	2 (2)	<0.001
Combined sutures and tissue adhesive	4 (4)	<0.001
Continuous nylon sutures	5 (5)	<0.001
None of the above	2 (2)	<0.001
<b>How many years have you been performing pterygium surgeries?</b>		
0-5 years	14 (14)	<0.001
5-10 years	16 (16)	<0.001
More than ten years	70 (70)	Ref.
<b>How many primary pterygium surgeries do you perform per year?</b>		
Less than 50	48 (48)	Ref.
50 to 100	27 (27)	0.002
More than 100	24 (24)	<0.001
None of the above	1 (1)	<0.001
<b>How many recurrent pterygium surgical cases per year?</b>		
Less than 5	53 (53)	Ref.
5 to 10	28 (28)	<0.001
10 to 50	18 (18)	<0.001
More than 50	1 (1)	<0.001
<b>Specialization in</b>		
Cornea	58 (58)	Ref.
Cataract	12 (12)	<0.001
Retina	4 (4)	<0.001
Glaucoma	4 (4)	<0.001
Strabismus	4 (4)	<0.001
Plastic surgery	3 (3)	<0.001
Refractive	2 (2)	<0.001
No subspecialization	10 (10)	<0.001
None of the above	2 (2)	<0.001
Other	1 (1)	<0.001
Ultrasonography	0	<0.001

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	n (%)	p-value
<b>Postoperative corticosteroid</b>		
Corticosteroid for 1 month	78 (78)	Ref.
Corticosteroid for 2 months	16 (16)	<0.001
Corticosteroid for 3 months	2 (2)	<0.001
None of the above	4 (4)	<0.001
<b>Postoperative care</b>		
Cyclosporine	8 (8)	<0.001
Anti-VGF eye drops	1 (1)	<0.001
Mitomycin	9 (9)	<0.001
Tacrolimus	6 (6)	<0.001
5-fluorouracil	1 (1)	<0.001
Other	9 (9)	<0.001
None	39 (39)	Ref.
Do not use	27 (27)	0.071
<b>Mitomycin C concentration (35 doctors do not use MMC)</b>		
0.02%	58 (58)	0.748
0.04%	7 (10.8)	0.748
<b>Mitomycin C time of use</b>		
30 seconds	15 (26.8)	0.281
60 seconds	24 (42.9)	0.058
120 seconds	17 (30.4)	0.403

VGF: Vascular Growth Factor; MMC: mitomycin-C.

**Table 2.** Comparison of answers to the questionnaire according to the number of years performing pterygium surgery

	0-10 years n (%)	More than 10 years n (%)	p-value
<b>Preferred technique</b>			
Conjunctival graft, if possible	26 (86.7)	63 (90.0)	0.625
P.E.R.F.E.C.T.	0	2 (2.9)	0.350
Bare sclera	0	2 (2.9)	0.350
Amniotic membrane	2 (6.7)	0	0.029
Rotational flap	1 (3.3)	2 (2.9)	0.898
Others	1 (3.3)	1 (1.4)	0.533
<b>Adjuvant Therapies: anti-VGF</b>			
Do not use	28 (93.3)	65 (92.9)	0.932
Pre-operative	0	1 (1.4)	0.511
Intra-operative	2 (6.7)	3 (4.3)	0.617
Post-operative	0	1 (1.4)	0.511
<b>Intraoperative</b>			
5- fluorouracil intra-op	2 (6.7)	3 (4.3)	0.617
Simblepharon lenses in symblepharon cases	7 (23.3)	17 (24.3)	0.919
Corticosteroid injection	1 (3.3)	11 (15.7)	0.081
Always symblepharon lenses	0	1 (1.4)	0.511
None of the above	20 (66.7)	30 (42.9)	0.029
Nothing	0	8 (11.4)	0.054
<b>Pterygium removal</b>			
Remove the body first and then the head	7 (23.3)	27 (38.6)	0.140
Remove the head first and then the body	6 (20.0)	13 (18.6)	0.867
Pullout	8 (26.7)	16 (22.9)	0.683
Delamination	9 (30.0)	14 (20.0)	0.276
<b>Tissue removed surgically</b>			
Resection of the head and conjunctiva with tenon removal	23 (76.7)	46 (65.7)	0.278
Minimal resection of the head and conjunctiva	0	4 (5.7)	0.181
Extensive resection up to the caruncle	0	1 (1.4)	0.511
None of the above	7 (23.3)	19 (27.2)	0.533
<b>Resected tenon tissue</b>			
Minimum	2 (6.7)	7 (10.0)	0.594
Intermediate	13 (43.3)	37 (52.9)	0.383
Extensive	15 (50.0)	26 (37.1)	0.231

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	0-10 years n (%)	More than 10 years n (%)	p-value
If proper conjunctival graft is not possible			
Minimal conjunctival graft	0	10 (14.3)	0.029
Amniotic membrane	13 (43.3)	16 (22.9)	0.039
Limbal cells	0	6 (8.6)	0.098
Bare sclera	2 (6.7)	5 (7.1)	0.932
Simple conjunctival closure	13 (43.3)	25 (35.7)	0.472
Labial mucosa	2 (6.7)	6 (8.6)	0.748
Do not use conjunctival graft	0	2 (2.9)	0.350
Graft adhesion			
Interrupted Vicryl® sutures	2 (6.7)	3 (4.3)	0.617
Interrupted nylon sutures	10 (33.3)	8 (11.4)	0.009
Commercial fibrin glue	17 (56.7)	47 (67.1)	0.317
Autologous fibrin glue	0	2 (2.9)	0.350
Combined sutures and tissue adhesive	0	4 (5.7)	0.181
Continuous nylon sutures	1 (3.3)	4 (5.7)	0.617
None of the above	0	2 (2.9)	0.350
Postoperative corticosteroid			
Corticosteroid 1 month	23 (76.7)	55 (78.6)	0.833
Corticosteroid 2 months	5 (16.7)	11 (15.7)	0.905
Corticosteroid 3 months	1 (3.3)	1 (1.4)	0.533
None of the above	1 (3.3)	3 (4.3)	0.824
Postoperative care			
Cyclosporine	2 (6.7)	6 (8.6)	0.748
Anti-VGF eye drops	0	1 (1.4)	0.511
Mitomycin C	0	9 (12.9)	0.040
Tacrolimus	1 (3.3)	5 (7.1)	0.462
5-fluorouracil	0	1 (1.4)	0.511
Other	0	9 (12.9)	0.040
None	13 (43.3)	26 (37.1)	0.561
Do not use	14 (46.7)	13 (18.6)	0.004

VGF: Vascular Growth Factor

**Table 3.** Comparison of answers to the questionnaire according to the number of pterygium surgeries performed

	Up to 10 n (%)	More than 10 n (%)	p-value
Preferred technique			
Conjunctival graft, if possible	72 (88.9)	17 (89.5)	0.942
P.E.R.F.E.C.T.	2 (2.5)	0	0.489
Bare sclera	2 (2.5)	0	0.489
Amniotic membrane	1 (1.2)	1 (5.3)	0.259
Rotational flap	3 (3.7)	0	0.394
Others	1 (1.2)	1 (5.3)	0.259
Adjuvant Therapies: ANTI-VGF			
Do not use	78 (96.3)	15 (78.9)	0.008
Pre-operative	1 (1.2)	0	0.626
Intra-operative	2 (2.5)	3 (15.8)	0.017
Post-operative	0	1 (5.3)	0.038
Intraoperative			
5-fluorouracil intra operative	4 (4.9)	1 (5.3)	0.953
Symblepharon lens cases in symblepharon cases	18 (22.2)	6 (31.6)	0.390
Corticosteroid injection	10 (12.3)	2 (10.5)	0.826
Symblepharon lens always	0	1 (5.3)	0.038
None of the above	42 (51.9)	8 (42.1)	0.444
None	7 (8.6)	1 (5.3)	0.625
Pterygium removal			
Remove the body first and then the head	28 (34.6)	6 (31.6)	0.804
Remove the head first and then the body	14 (17.3)	5 (26.3)	0.366
Pullout	20 (24.7)	4 (21.1)	0.738
Delamination	19 (23.5)	4 (21.1)	0.823

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	Up to 10 n (%)	More than 10 n (%)	p-value
Tissue removed surgically			
Resection of the head and conjunctiva with tenon removal	53 (65.4)	16 (84.2)	0.111
Minimal resection of the head and conjunctiva	4 (4.9)	0	0.323
Extensive resection up to the caruncle	1 (1.2)	0	0.626
None of the above	23 (26)	3 (15.8)	0.489
Resected tenon tissue			
Minimum	7 (8.6)	2 (10.5)	0.796
Intermediate	40 (49.4)	10 (52.6)	0.799
Extensive	34 (42.0)	7 (36.8)	0.682
If proper conjunctival graft is not possible			
Minimal conjunctival graft	10 (12.3)	0	0.106
Amniotic membrane	20 (24.7)	9 (47.4)	0.050
Limbal cells	4 (4.9)	2 (10.5)	0.356
Bare sclera	6 (7.4)	1 (5.3)	0.742
Simple conjunctival closure	33 (40.7)	5 (26.3)	0.244
Labial mucosa	6 (7.4)	2 (10.5)	0.652
Do not use conjunctival graft	2 (2.5)	0	0.489
Graft adherence			
Interrupted Vicryl® sutures	4 (4.9)	1 (5.3)	0.953
Interrupted nylon sutures	16 (19.8)	2 (10.5)	0.346
Fibrin glue	51 (63.0)	13 (68.4)	0.656
Autologous fibrin glue	2 (2.5)	0	0.489
Combined sutures and tissue adhesive	2 (2.5)	2 (10.5)	0.107
Continuous nylon sutures	4 (4.9)	1 (5.3)	0.953
None of the above	2 (2.5)	0	0.489
Postoperative corticosteroid			
Corticosteroid 1 month	63 (77.8)	15 (78.9)	0.912
Corticosteroid 2 months	13 (16.0)	3 (15.8)	0.978
Corticosteroid 3 months	2 (2.5)	0	0.489
None of the above	3 (3.7)	1 (5.3)	0.755
Postoperative care			
Cyclosporine	6 (7.4)	2 (10.5)	0.652
Anti-VGF eye drops	0	1 (5.3)	0.038
Mitomycin	8 (9.9)	1 (5.3)	0.527
Tacrolimus	6 (7.4)	0	0.221
5-fluorouracil	1 (1.2)	0	0.626
Other	6 (7.4)	3 (15.8)	0.251
None	31 (38.3)	8 (42.1)	0.758
Do not use	23 (28.4)	4 (21.1)	0.516

VGF: Vascular Growth Factor

## DISCUSSION

Graue-Hernandez et al. conducted a study to determine the preferred surgical techniques for treating primary pterygium. The findings revealed that the most preferred method involved the complete removal of the pterygium, moderate removal of Tenon capsule, and an autologous graft (either conjunctival or limbo conjunctival). The study also found that fibrin glue was the preferred method for graft fixation (61.2%). Among the sutures used, interrupted Vicryl® sutures were the most preferred. Additionally, prednisolone acetate was found to be the preferred corticosteroid. The study also compared the surgical techniques of experienced surgeons (10a+) and less experienced ones (10a-) and found that the more

experienced surgeons were less aggressive in removing Tenon capsule.<sup>(1)</sup>

After analyzing the responses to the questionnaires, we discovered that most physicians do not use antiangiogenic therapy (anti-VGF) ( $p < 0.05$ ) with their patients. However, physicians who perform more than ten recurrent pterygia per year (10c+) tend to use more anti-VGF ( $p < 0.05$ ) when compared to others (10c-). In an extensive review conducted by Zhang et al. on the association of anti-VGF with different techniques, it was found that the bare sclera technique showed lower recurrence, the ACG had a lower effect on recurrence, and greater effects were observed for recurrence prevention in white males.<sup>(6-32)</sup> Sun et al. found lower recurrence rates with autologous grafting for anti-VGF treatment.<sup>(31)</sup> Kasetsuwan et al. conducted a study on primary pterygium using 0.05% eye drops, which showed no decrease in recurrence.<sup>(32)</sup> Zhang et al. reviewed studies on recurrent pterygium and found mainly temporary results using bevacizumab. However, a lower recurrence rate was associated with a 2.5mg subconjunctival injection.<sup>(8)</sup> In our survey, the number of surgeons who reported using this medication was small, possibly due to inconsistent findings and a lack of agreement on the best administration method.

Bevacizumab's primary purpose is to reduce fibrosis and vascularization. However, studies suggest it is most effective preoperatively or intraoperatively since its effects are temporary, usually lasting about two weeks. The preoperative goal is to minimize fibrosis and vascularization, as pterygia with lower levels of these factors are less likely to recur. Conversely, perioperative and postoperative applications aim to reduce early recurrence.<sup>(8-11)</sup>

One month of postoperative corticosteroid use produced statistically significant results. Although there was increased usage with greater experience, this increase was not statistically significant. Phathanthurarux et al. surveyed Thailand and discovered that 50% of the respondents preferred using corticosteroids within 4 to 8 weeks after surgery.<sup>(10)</sup> Our research showed that many surgeons used a specific treatment for 4 to 8 weeks, with four weeks being the most common duration. This is consistent with a previous study. The longer treatment duration may be because reducing inflammation decreases the likelihood of pterygium recurrence, especially in cases with prior recurrences.<sup>(1,10)</sup>

Symblepharon lenses are commonly used when treating these patients. Surgeons with fewer years of experience (10a-) mostly used this lens; 10c+ surgeons always

used it. However, these data were collected from only one surgeon and should be interpreted carefully. There are no studies on Symblepharon lens use in patients with recurrent pterygium. Nevertheless, most surgeons use this lens to prevent new Symblepharon formation in recurrent cases.

When it comes to removing tissue, most surgeons remove the head of the pterygium, including the conjunctiva and tenon, without invading the caruncle or base. Our results are similar to those of similar studies, even though we evaluated recurrent pterygium.<sup>(1)</sup>

Regarding the surgical technique used, most doctors prefer to remove the body first and then the head ( $p < 0.05$ ), with delamination and pullout techniques having similar preferences. When comparing the experience of doctors in terms of years or number of surgeries, 10a+ surgeons preferred to remove the body first and then the head. In contrast, 10a- surgeons preferred the delamination technique. Kotb et al. reported successful uncomplicated pullouts and high aesthetic satisfaction among patients.<sup>(11)</sup> Uçar et al. compared neck and pterygium cutting to removal by pulling out, finding similar results.<sup>(5)</sup> Several studies have been conducted to determine the effectiveness and safety of various techniques used in primary pterygia treatment. However, care should be taken to mitigate the risk of pullout in recurrent pterygium cases, where the pterygium is more strongly adhered to the cornea. Our research suggests that the body is more frequently removed before the head because of MMC used by many surgeons who treat recurrent pterygia. This helps protect the cornea by removing the head from the pterygium after MMC application.

Regarding the amount of Tenon capsule removed, most surgeons prefer intermediary removal ( $p < 0.05$ ). However, when Tenon capsule was evaluated, there was a preference for more extensive removal ( $p < 0.05$ ). Uçar et al. compared limited and wide Tenon capsule resection to the medial rectus. They found that there were paradoxically more recurrences with extensive resection.<sup>(5)</sup> Studies investigated the P.E.R.F.E.C.T. technique for recurrent pterygia. They resected Tenon capsule extensively and used ACG. No recurrences or complications were reported after surgery.<sup>(12)</sup> Removing more capsular tissue may help prevent recurrence. However, it is still uncertain whether we are removing tissue that is not necessary or increasing the risk of complications. Although the first P.E.R.F.E.C.T. technique study revealed fewer complications, there was considerable morbidity. A study that compared extensive removal with more conservative removal found no difference in recurrence rates between the two.<sup>(12)</sup> A study

was carried out to investigate the recurrence in patients with minor tenon resection associated with MMC and it showed promising results.<sup>(12,13)</sup>

It is interesting to note that in a questionnaire study on primary pterygia, fewer experienced surgeons (10a+) and those with more surgeries performed (10c+) opted for aggressive Tenon removal. Most surgeons did not use specific adjuvant therapies during the postoperative period. However, the use of mitomycin in the postoperative period was significantly higher among a small group of experienced surgeons (10a+). Phathantharurux et al. also studied preferred treatments for primary pterygia. They found that most surgeons did not use adjuvant therapies; however, mitomycin was the most used among those who did.<sup>(10)</sup> Taher et al. conducted a study on the use of intraoperative mitomycin in primary pterygium. They found that 0.02% intraoperative application resulted in better outcomes with a recurrence rate of 1.4%.<sup>(4)</sup> Ghiasian et al. reviewed recurrent pterygium and found various therapies mentioned above but recommended weekly subconjunctival 5-FU in recent recurrences.<sup>(9)</sup> Kusano et al. found higher recurrence rates in males and patients who did not receive intraoperative mitomycin.<sup>(14)</sup> Kam et al. compared the recurrence rates of MMC alone, ACG only, and both in pterygia and found them to be similar.<sup>(14,15)</sup> In our study, MMC was statistically used more often for recurrent pterygium than for primary pterygium, according to a previous similar study.<sup>(1)</sup> Kotb et al. discovered that 46 surgeons used MMC 0.04% for 2 minutes, double the standard 0.02% dosage.<sup>(11)</sup> Our study used 0.02% for 60 seconds, which is consistent with the literature.<sup>(1,15-18)</sup>

Karadag et al. studied cyclosporine and recurrence and found no decrease associated with the medication.<sup>(19)</sup> Studies have demonstrated that cyclosporine's cellular effect on pterygium recurrence is linked to its purported effects; however, such effects were not observed in clinical practice.<sup>(20)</sup> Our questionnaire showed that few surgeons used both cyclosporine and 5-FU.

A study found that simple closure was the most common option for closure in cases where an ACG was impossible. This option was statistically significant ( $p < 0.05$ ). However, other options such as minimal ACG, limbal cells, bare sclera, or labial mucosa were also used frequently but were not statistically significant.

Regarding the use of Amniotic Membrane (AM), those who had performed fewer than ten surgeries (10c-) opted for simple closure without statistical significance. Those who had performed ten or more surgeries (10a-) used fewer AMs ( $p < 0.05$ ), whereas those who had undergone ten

or more surgeries and had experience with positive outcomes (10a+) preferred to use any possible graft, minimal ACG ( $p < 0.05$ ), or limbal cells ( $p = 0.01$ ). Those who had performed ten or more surgeries with adverse outcomes (10c+) used more AMs ( $p < 0.05$ ).

A comparison of AMG and ACG, with and without MMC, in patients with recurrent pterygia revealed that MMC + ACG resulted in better outcomes. In contrast, the use of AMG alone resulted in worse outcomes. The study was conducted by Kim et al.<sup>(16)</sup> Oke et al. reported a 15% rate of bare sclera surgeries in the country.<sup>(17)</sup> Oliva-Biénezobas et al. compared mini-SLET and ACG in primary pterygia, with higher recurrence in the mini-SLET group.<sup>(18)</sup> Phathantharurux et al., in their study, found ACG (44.9%) and then AM (42%) as a preference for recurrent pterygium.<sup>(10)</sup> Taher et al. compared ACG and AM with MMC with no statistical differences in recurrence.<sup>(4)</sup> Lee et al. studied graft rotation with good results, even in recurrent pterygium.<sup>(21)</sup> Sati et al. compared ACG and mini-SLET with longer surgical time in the mini-SLET group and lower recurrence in the same group.<sup>(22-29)</sup> Kodavoor et al. conducted a successful study on removing the ACG in recurrent pterygia at the site of previous ACG removal without increasing the recurrence rate.<sup>(23)</sup> Desai et al. also studied the effectiveness of the TissueTuck technique, which involves AMG, tenectomy, and MMC application, and achieved excellent results in treating recurrent pterygia.<sup>(3)</sup> On the other hand, Wadgy et al. compared the use of ACG with MMC and ACG with Ologen and found that the Ologen group had more cases of recurrence.<sup>(33)</sup>

The literature and meta-analyses demonstrate that limbal cells play a vital role in preventing the recurrence of pterygia, which is corroborated by the feedback provided by experienced surgeons in our study. According to the literature, using an AMG as a substrate for germinative cell growth is crucial, making its combination in recurrent pterygia compelling. Using an isolated AM combined with MMC has shown superior outcomes in treating recurrent pterygia cases where ideal grafting is challenging. When faced with such difficult cases, harvesting as many germinative cells as possible with the help of AM is a viable option, if available, with the aid of MMC. In the most challenging scenarios, labial mucosa can also be used.<sup>(1,4,10,16-23)</sup>

In a study about ACG adhesion, most participants preferred commercial fibrin glue ( $p < 0.05$ ), followed by an interrupted suture with nylon. The 10a group opted for more sutures ( $p < 0.05$ ). In another study by Phathantharurux et al., nonabsorbable sutures (53.4%)

were the preferred choice, followed by absorbable ones (33.1%).<sup>(10)</sup> Jamali et al. found that while nylon and Vicryl® sutures had similar comfort and recurrence results, removing nylon sutures was difficult.<sup>(24)</sup>

Mejía et al. conducted a study comparing cautery, sutures, and glue and found that, while cautery was more comfortable, it did not significantly increase the recurrence rate.<sup>(25)</sup> Bilge et al. compared ACG with graft rotation, with similar results.<sup>(26)</sup> A literature review found superior results in preventing recurrent pterygia with ACG compared to AM. However, it was inconclusive whether using MMC influences the recurrence rate.<sup>(27,28)</sup> Romano et al. conducted a comprehensive review and found that fibrin glue yielded better recurrence, surgical time, and comfort results than sutures.<sup>(28)</sup>

Our study agrees with most of the studies in the literature, which prefer using fibrin glue as a surgical adhesive. However, a study conducted in a lower-income country found a higher use of sutures, which could be attributed to the financial aspect of fibrin glue. Therefore, there is a need for further studies to explore the use of alternative methods such as the use of autologous blood, fibrin glue produced with autologous blood, and cautery.<sup>(24-27)</sup> Our questionnaire found that fibrin glue was preferred for recurrent pterygium and sutures due to increased care.

Panda et al. investigated the correlation between surgeon experience and recurrence rate in primary pterygium surgery using pterygium autograft with patient blood. However, they did not find any significant correlation between experience and recurrence. Surgical time was longer in the resident group.<sup>(27)</sup> Sharma et al. successfully studied surgeries with ACG without sutures and glue, even in recurrent pterygium.<sup>(7)</sup> Maiti et al. studied ACG adhered with fibrin, sutures, and autologous blood (AB) with lower recurrence than ACG and suture but greater graft stability in ACG.<sup>(28-30)</sup> Paganelli et al. compared ACG, limbal graft (LCG), and AMG recurrence rates over 30 years. Results show that LCG had the lowest recurrence rate of 5.50%, followed by ACG with 7.61% and AMG with 9%.<sup>(2)</sup>

Our study aimed to analyze the results among experienced surgeons who had performed more surgeries per year of recurrent pterygium. We found greater agreement between the techniques they chose and those with the best outcomes in the literature. This highlights that surgical experience, particularly with more cases, is crucial when deciding the best treatment plan for recurrent pterygium.

The ophthalmologists in our study had subspecializations in cornea, cataract, retina, glaucoma, strabismus,

plastic, refractive, and ultrasonography. Some specialists felt they needed further subspecialization, while others thought they needed none.

It is important to note that our study has limitations, such as a small number of participants due to a lack of adherence to the questionnaire response. Additionally, it was not a randomized clinical trial, and there validated questionnaires are needed for preferred techniques in recurrent pterygium.

## CONCLUSION

Upon evaluating the answers to the questionnaire, we found that surgical experience, particularly the number of surgeries performed, is crucial in deciding the surgical plan for recurrent pterygium. We also saw a preference for some techniques or therapies, such as fibrin glue, intermediate resection of the tenon, 0.02% MMC for 60 seconds, and postoperative corticosteroids for one month, among others.

## AUTHOR CONTRIBUTIONS

Substantial contribution to conception and design: Bernardo Kaplan Moscovici; Mariana Garcia Herrero Juliani  
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Statistical analysis: Bernardo Kaplan Moscovici; financial support: none  
Administrative, technical, or material support supervision: Sergio Felberg; Debora Marcolini Schneider Felberg; Bernardo Kaplan Moscovici  
Research group leadership: Sergio Felberg; Debora Marcolini Schneider Felberg; Bernardo Kaplan Moscovici.

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## Supplement 1. Questionnaire

Question 1: Technique of choice:

- A) Conjunctival graft, if possible.
- B) Amniotic membrane
- C) Labial mucosa
- D) Bare sclera
- E) Flap Rotation
- F) Perfect P.E.R.F.E.C.T.
- G) Simple Limbal Epithelial Transplantation (SLET) or similar
- H) Ologen
- I) Other

Question 2: Adjunctive therapies: anti-VFG:

- A) Anti-VGF Preoperative
- B) Anti-VGF Intraoperative
- C) Anti-VGF Postoperative
- D) Not Used

Question 3: Intraoperative mitomycin:

- A) 30 seconds
- B) 60 seconds
- C) 120 seconds
- D) Not Used

Question 4: Concentration:

- A) 0.02%
- B) 0.04%

Question 5: Intraoperative:

- A) Intraoperative 5- fluoracil
- B) Intraoperative corticosteroid injection
- C) Symblepharo lens Always
- D) Lens Symblepharo in cases with symblepharon

Question 6: Removal of pterygium:

- A) Delamination
- B) Pullout
- C) Remove the body first and then the head

Question 7: Surgically removed tissue:

- A) Resection to the limbus
- B) Minimal resection of the head and conjunctiva
- C) Extensive resection of the head and conjunctiva, including base
- D) Extensive resection up to the caruncle

Question 8: Removal of tenon capsule:

- A) Minimum
- B) Intermediate
- C) Extensive

Question 9: If you normally use a conjunctival graft, and it is impossible in one case:

- A) Simple conjunctival closure
- B) Bare sclera
- C) Minimal conjunctival graft
- D) Limbal cells
- E) Labial mucosa
- F) Amniotic membrane
- G) I do not use conjunctival grafts

Question 10: Graft adhesion:

- A) Autologous fibrin glue
- B) Interrupted nylon sutures
- C) Continuous nylon sutures
- D) Interrupted Vicryl® sutures
- E) Continuous Vicryl® sutures
- F) Commercial fibrin glue
- G) Combined sutures and tissue adhesive
- H) Cautery

Question 11: How many years have you been operating pterygium?

- A) 0 to 5 years
- B) 5 to 10 years
- C) More than 10 years

Question 12: How many pterygia surgeries you performed per year?

- A) Less than 50
- B) From 50 to 100
- C) More than 100

Question 13: How many pterygia recurrent surgeries you performed per year?

- A) Less than 5
- B) 5 to 10
- C) 10 to 50
- D) More than 50

Question 14: Do you have a subspecialization in:

- A) Plastic surgery
- B) Cornea
- C) Refractive
- D) Uveitis
- E) Retina
- F) Glaucoma
- G) Strabismus
- H) Neurophthalmos
- I) Cataract
- J) Contact lenses
- K) Tumor
- L) USG
- M) Other
- N) No subspecialization