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Preoperative Argon Laser Photocoagulation to Reduce Postoperative Recurrence of Pterygium

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ABSTRACT

Background: Pterygium is ocular surface disease, pinkish, triangular tissue growth on the cornea of the eye, if it grows so large it covers the pupil and impairs vision. Argon laser essentially destroy tissue in order to have a beneficial effect on the eye. **Objectives:** To evaluate the effect of argon laser application pre- and postoperative by bare sclera technique on primary pterygium recurrence rate.

Methods: The research comprised 40 eyes of 40 patients with primary pterygium and divided them into two equal groups: group A had argon laser photocoagulation one week before surgery via bare sclera, and group B underwent pterygium removal. All patients underwent preoperative ocular examinations, including visual acuity, refraction, pupils, extra-ocular motility, intraocular pressure measurement by Goldmann applanation tonometer, external examination, slit lamp examination, and (+90D) lens-dilated fundus examination with biomicroscopy.

Results: The recurrence rate decreased more in group A, 25%, than in group B, 50%. Epithelial healing was almost equal in both groups but signs of inflammation were resolved faster in group A. Irritative symptoms decreased in the two groups pre- and postoperative. Highly statistically significant reduction of length of pterygium on cornea was 1.40±0.28 after treatment in recurrent compared to before treatment in group A. Statistically significant reduction of length of pterygium on cornea was 0.60±0.28 after treatment in recurrent compared to before treatment in group B.

Conclusion: The laser-treated group exhibited superior outcomes across multiple parameters, highlighting its potential to enhance both clinical and structural outcomes in patients undergoing pterygium excision.

Keywords: Pterygium, Recurrence, Preoperative, Argon Laser.

INTRODUCTION

Pterygium is a common ocular surface disorder that originates in the limbal conjunctiva inside the palpebral fissure and advances to the cornea. The nasal limbus lesion, like a wing, is more prevalent than the temporal variant. The aetiology is unidentified. Residents near the equator and those exposed to ultraviolet radiation have a greater prevalence. Males have a higher incidence than females, maybe because to increased UV exposure [1]. Pterygium is often asymptomatic but may cause inflammation and irritation of the eye. As the lesion advances, astigmatism or obscuration of the visual axis may arise. The appearance of the lesion dictates the diagnosis of pterygium. Fibrovascular conjunctival growth in the palpebral fissure is obscuring the cornea. A pterygium exhibiting a pigmented epithelial iron line (Stocker's line) signifies chronicity [2]. Pterygia seldom strays from the three and nine o'clock locations of the palpebral fissure. The use of sunglasses, wide-brimmed hats, and artificial tears during daylight may impede their formation or growth [3]. Conservative treatment using lubrication, surgical excision, and laser therapy is provided for pterygia. Pterygium treatment includes bare sclera surgery and autografting, which involves covering the bare sclera with intact conjunctival tissue. Autologous tissues are transplanted to the denuded sclera and secured with sutures or tissue glue. Amniotic membrane transplantation employs tissue from the deepest layer of the placenta to restore and repair compromised mucosal surfaces, including the ocular surface. Amniotic grafts enhance epithelialisation and diminish inflammation. **Ginger-Eke *et al.*** [4] used mitomycin C eye drops for the treatment of initial and recurring pterygium post-surgery.

Argon lasers produce monochromatic blue-green light within a limited bandwidth of 406.7 nm to 676.4 nm. Lasers treat pterygium, glaucoma, and diabetic retinopathy. Blue and green wavelengths traverse ocular fluid without causing damage. The argon gas laser coagulates and cauterises blood vessels. It aims at a particular site and surpasses other medications [5].

Argon lasers induce photocoagulation of blood vessels. The absorption of light elevates tissue temperature. This denatures proteins, constricts blood vessels, and reduces pterygium vascularization, hence decreasing its size and recurrence. When used with naked sclera, argon lasers occlude conjunctival arteries without causing burns preoperatively or postoperatively. Blue and blue-green exhibit the most potent wavelengths. In continuous wave mode, the argon gas laser may generate very short pulses [6].

The current study was performed to assess the effect of argon laser photocoagulation before pterygium surgery to reduce postoperative recurrence.

PATIENTS AND METHODS

1. Study design and population:

This study was a prospective, interventional and randomized clinical study performed at Ophthalmology Department, Menoufia University Hospital between January 2023 and April 2024. Forty eyes of forty patients with primary pterygium were included in this study and were classified into two equal groups A and B. Patients were divided randomly according to certain criteria. Patients were included if they had primary pterygium and their ages more than 18 years old. Individuals were excluded from the study if they had a

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prior history of any eye-related conditions, such as injury, infection, or inflammation, as well as trauma or surgery within the last six months. Additionally, those undergoing concurrent treatments that might affect the study's findings or possessing any uncontrolled systemic diseases or significant health issues were also excluded.

- ***Group A:*** Twenty eyes of twenty patients were treated by argon laser one week before surgery by bare sclera technique.
- ***Group B:*** Twenty eyes of twenty patients were treated by bare sclera technique only.

Follow up period was from 6-9 months.

2. Preoperative ocular examination:

Visual acuity, refraction, pupils, extra-ocular motility, intraocular pressure measurement by Goldmann applanation tonometer, external examination, slit lamp examination and dilated fundus examination using (+90D) lens with biomicroscopy. It is essential to enhance ocular surface health prior to surgery by addressing dry eye syndrome, which can contribute to recurrence, and by scheduling the procedure to avoid the summer months. Key considerations encompass informing the patient regarding sun protection measures. In group A two lines of argon green laser photocoagulation to pterygium body was applied one week before surgery using an argon setting of 200 µm to spot size, 500 mW, 0.1 second. Argon laser and the number of pulses was (32- 100).

3. Operation:

The pterygium was injected with a small amount of lidocaine with epinephrine to elevate the subconjunctival tissue (**Figure 1)**. The pterygium was dried, and the body was excised with toothed forceps and scissors **(Figure 2)**. The excision took place approximately 1 mm above and below the limbal crossing points to reduce the risk of recurrence at these locations. It was crucial to excise the inflamed tissue along with the plica/caruncle while ensuring that the procedure remains superficial to the check ligaments and the sheath of the medial rectus muscle in order to achieve optimal postoperative cosmesis. Head avulsion occurred by holding the excised body by toothed forceps (**Figure 3)**, minimizing the amount of corneal tissue excised. Excessive blood was controlled by sterile sponge to keep surgical view dry. Residual tissue was scraped from the corneal surface using the sharp or posterior border of blade 11 to keep corneal surface smooth and the bare sclera area clean to decrease recurrence rate (**Figure 4 and 5)**. Care was taken to minimize limbal damage. In group B, the application of an intraocular diathermy tip effectively reduced bleeding. Special attention was devoted to identifying any bleeding points within and beneath the edges of the conjunctival cut.

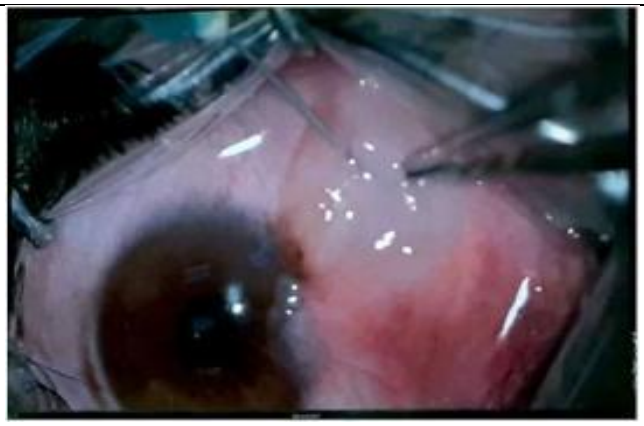

Figure (1): Injection of a small amount of lidocaine with epinephrine to elevate the subconjunctival tissue as local anesthesia.

Figure (2): Excision of pterygium body by toothed forceps and scissors.

Figure (3): Avulsion of the head away from the cornea by toothed forceps and drying surgical field by sterile sponge.

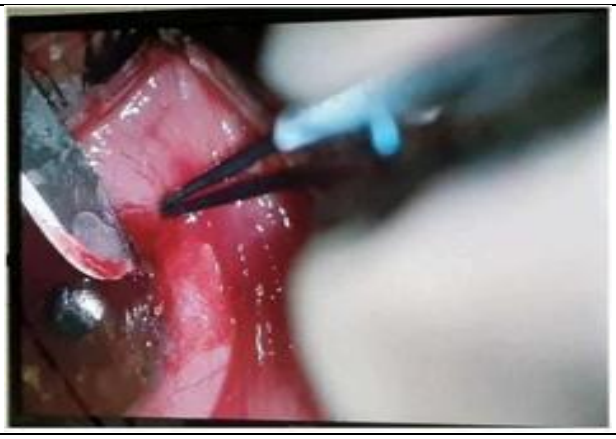

Figure (4): Cleaning the corneal surface by posterior border of blade 11.

Figure (5): Clean bare sclera area after surgical excision.

Figure (6): Argon laser device.

4. Process of Argon Laser Treatment:

In our study we used Nidek Green Laser 532nm Argon Laser device (USA) **(Figures 6)**.

The local anaesthetic drops were administered into the eye to numb the surface. The patient was instructed to sit at the laser machine and rest their chin on the support. As the procedure began, the patient heard the clicks of the machine activating and observes bright flashes of light. Maintaining a steady gaze was crucial; it was essential to keep the eyes open and avoid any tension in the eyelids. The duration for this process was approximately 5 to 10 minutes. The individual might encounter temporary discomfort or sensitivity in the eyes during and after the procedure. Pain was uncommon, yet it could be managed with a mild pain reliever such as paracetamol, along with prescribed eye drops or ointment.

5. Postoperative management:

Immediate postoperative treatment was antibiotic-steroid drops every 2 hours/day for the first 2 days and then 6 hours/day up to 7 days, antibiotic-steroid ointment for 3 days and artificial tears applied 2 hours for first 3 - 4 days to keep the corneal surface moist. Follow-up visits were arranged at 1, 2, 3, 6, and 9 months. Conjunctival hyperemia along with irritative symptoms, including lacrimation and itching, were observed and analyzed in relation to preoperative complaints. The measurement of the lesion's length on the cornea during recurrence was conducted utilizing the narrow beam of the slit lamp.

Ethical Consideration:

We got all the research permissions. The Menoufia University Faculty of Medicine Ethics Committee authorized this research. After describing the study's goal, each participant gave informed oral permission. Patients had full secrecy and might reject to participate without affection. The study adhered to the Helsinki Declaration throughout its execution.

Statistical analysis

Recorded data were analyzed using SPSS-23. Kolmogorov-Smirnov and Shapiro-Wilk tests examined normality. Quantitative data were reported as mean± standard deviation and ranges. Qualitative data were reported as numbers and percentages. The used tests were independent-samples t-test and chi-square test. P-value <0.05 indicated significance.

RESULTS

In table (1): no statistically significant differences were found between groups regarding age sex, and laterality.

Table (1): Comparison between groups according to demographic data, laterality

Demographic data	Group A (n=20)	Group B (n=20)	Test value	P-value	Sig.
Age "years"					
Mean±SD	47.65±9.90	48.05±8.64	0.136	0.892	NS
Range	30-68	32-60			
Sex					
Female	7 (35.0%)	10 (50.0%)	0.921	0.337	NS
Male	13 (65.0%)	10 (50.0%)			
Laterality					
LT	5 (25.0%)	10 (50.0%)	2.667	0.102	NS
RT	15 (75.0%)	10 (50.0%)			

Using: t-Independent Sample t-test for Mean±SD; Using: x^2: Chi-square test for Number (%), LT: Left, RT: Right, NS: Non significant.

In table (2); a statistically significant highest mean value of signs of inflammation resolved (days) in group B was 10.90±2.27 compared to group A was 9.25±2.49, while, there was no statistically significant difference between Group A and Group B according to epithelial healing (days).

Table (2): Comparison between Group A and Group B according to sign of inflammations resolved and epithelial healing

		Group A (n=20)	Group B (n=20)	Test value	P-value	Sig.
Sign of inflammations resolved (days)	Mean ± SD	9.25±2.49	10.90±2.27	2.800	0.035	S
	Range	7-14	7-14			
Epithelial healing (days)	Mean ± SD	9.50±2.06	9.90±1.33	0.730	0.471	NS
	Range	7-14	7-14			

Using: t-Independent Sample t-test for Mean ± SD; NS: Non significant; S: Significant.

In table (3); a statistically significant difference was found between groups regarding recurrence with increase recurrence in group B in10 patients (50%) compared to group A in 5 patients (25%), while, there was no statistically significant difference between groups according to time till recurrence (months).

Table (3): Comparison between Group A and Group B according to recurrence and time till recurrence (months).

		Group A (n=20)	Group B (n=20)	Test value	P-value	Sig.
Recurrence	No	15 (75.0%)	10 (50.0%)	2.667	0.102	NS
	Yes	5 (25.0%)	10 (50.0%)			
Time till recurrence (months)	Mean±SD	5.40±0.89	4.60±1.17	2.434	0.20	S
	Range	4-6	3-6			

Using: t-Independent Sample t-test for Mean ± SD; Using: x^2: Chi-square test for Number (%), NS: Non significant; S: Significant.

In table (4); a statistically significant more reduction in group A compared to group B according to length of pterygium on cornea after: treatment (mm) in recurrent and difference, and there was a highly statistically significant reduction of length of pterygium on cornea (mm) was 1.40±0.28 after treatment in recurrent compared to before treatment in group A. Also, statistically significant reduction of length of pterygium on cornea (mm) was 0.60±0.28 after treatment in recurrent compared to before treatment in group B.

Table (4): Comparison between Group A and Group B according to length of pterygium on cornea before and after treatment (mm).

		Group A (n=20)	Group B (n=20)	Test value	P-value	Sig.
Length of pterygium on cornea: before treatment (mm)	Mean±SD	3.22±0.64	2.96±0.60	1.325	0.193	NS
	Range	2-3.5	2-3.8			
Length of pterygium on cornea: after treatment (mm) in recurrent	Mean±SD	1.82±0.30	2.36±0.42	4.679	<0.001	HS
	Range	1.4-2.2	1.9-3.2			
Difference	Mean±SD	1.40±0.28	0.60±0.28	9.035	0.001	HS

Using: t-Independent Sample t-test for Mean±SD; NS: Non significant; HS: Highly significant.

In table (5): The increase irritative symptoms: after treatment in group B was 8 patients (40%) compared to group A was 6 patients (30%), but with insignificant difference.

Table (5): Comparison between Group A and Group B according to irritative symptoms after treatment.

Irritative symptoms after treatment	Group A (n=20)	Group B (n=20)	Test value	P-value	Sig.
Absent	14 (70.0%)	12 (60.0%)	0.44	0.507	NS
Present	6 (30.0%)	8 (40.0%)			

Using: x^2: Chi-square test for Number (%), NS: Non significant.

CASE PRESENTATION

In figure (7): Comparison of 2 groups with no recurrence in 2 cases, in Figure (7a): No recurrence of pterygium after treatment by surgery only, Figure (7b): No recurrence of pterygium after treatment with surgery and laser.

Figure (7a): No recurrence of pterygium after treatment by surgery only.

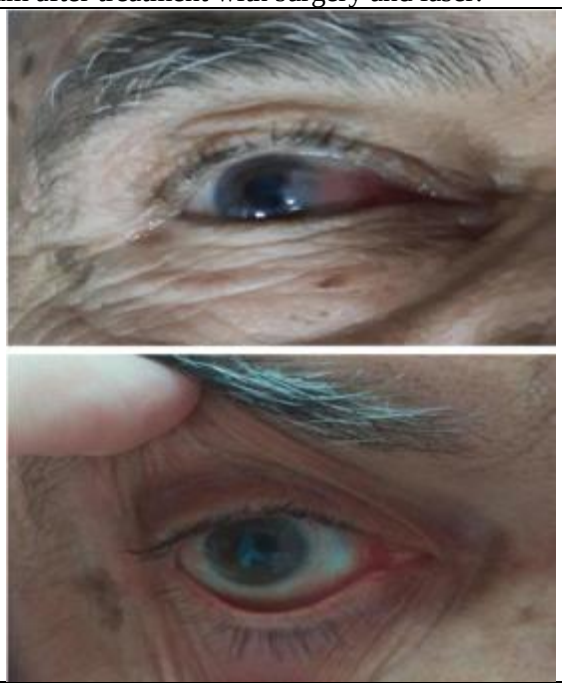

Figure (7b): No recurrence of pterygium after treatment with surgery and laser.

In figure (8), the length after surgery only is longer than before surgery pterygium becomes fleshier and more vascular. While the length after surgery and laser is less than before surgery and laser. No complications reported in our study during surgery and after laser application except recurrence. [(A) before treatment (B) after treatment by surgery only] [(C) before treatment (D) after treatment by surgery and laser]

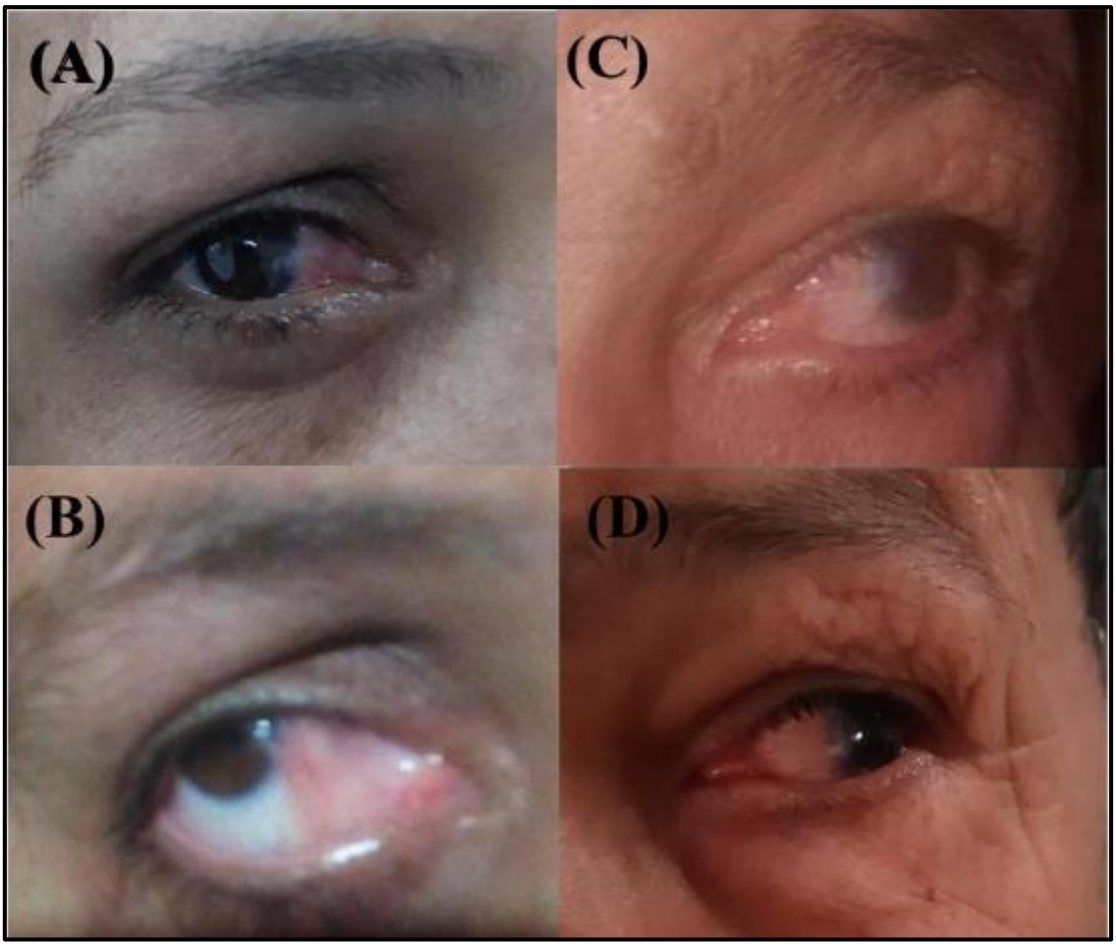

Figure (8): Length of pterygium on cornea before and after treatment in primary recurrent cases.

DISCUSSION

Surgical procedures are the main treatment for pterygium, but recurrence is tough. Bare sclera excision, conjunctival autograft placement, and amniotic membrane transplantation have evolved. These procedures risk recurrence is due to blood vessel regrowth. The bare sclera method has a 38%–88% recurrence rate. To reduce this risk, adjunctive therapies such as mitomycin C, 5-fluorouracil, anti-VEGF agents, cryotherapy, beta radiation, and laser treatments have shown promise [7]. Since pterygium surgery is controversial and often associated with high recurrence rates, evaluating the effectiveness of argon laser therapy before excision was a main focus [8].

To reduce postoperative recurrence, this study examined the effects of argon laser photocoagulation before pterygium surgery.

This prospective, interventional, and randomized clinical trial separated 40 primary pterygium patients over 18 into two groups. A group of 20 patients had argon laser photocoagulation one week before the bare sclera surgery, whereas Group B (control group) of 20 patients underwent the surgery alone. We followed both groups for 6-9 months using the same inclusion and exclusion criteria.

We found few studies evaluating the effectiveness of argon laser therapy before pterygium excision on recurrence, which is strength of our study. Both groups had similar age and sex distributions, assuring comparison. Pterygium laterality did not vary across groups statistically. Baseline consistency improved the observed results' validity.

Our research had similar demographics to earlier studies, with no significant variations between treatment groups' ages and sex ratios. Similar baseline characteristics match study methodologies like **Motargemizadeh *et al.*** [7] who conducted a randomized prospective trial that included 60 eyes from 53 patients to evaluate whether the addition of argon laser therapy could lower recurrence rates and minimize complications following two surgical techniques: bare sclera excision alone and excision with adjunct argon laser therapy and **Abd-Elkhalak *et al.*** [9] who conducted a prospective interventional study involving 20 eyes from 20 patients, randomly divided into two groups. One group got preoperative and after argon laser photocoagulation, whereas the other had surgery alone, assuring the validity of intergroup comparisons.

However, compared to **Arish and Dakkali** [8], who conducted a prospective interventional study that included 30 patients with 60 eyes, divided into two treatment groups: one receiving preoperative laser therapy and the other undergoing surgery alone to determine whether preoperative laser therapy could reduce recurrence rates and improve surgical outcomes and reported a younger mean participant age (45.7

years), our study's slightly older cohort (mean age ~48 years) may indicate a broader age representation in assessing laser therapy efficacy.

The findings of our research demonstrate the considerable influence of preoperative argon laser photocoagulation on enhancing surgical outcomes in pterygium therapy. One of the important outcomes of our research was the quicker resolution of inflammation in the laser-treated group, where the average time for indications of inflammation to diminish was 9.25±2.49 days compared to 10.90±2.27 days in control group (p=0.035). This implies that preoperative argon laser photocoagulation leads to speedier postoperative recovery. However, epithelial healing periods between the two groups were similar, with no statistically significant difference found.

Regarding recurrence rate, the recurrence rate of pterygium was much lower in laser-treated group, with only 25% of patients reporting recurrence, compared to 50% in control group (p=0.047), highlighting the effectiveness of preoperative argon laser photocoagulation. While the average time to recurrence was somewhat longer in the laser-treated group (5.40±0.89 months) than the control group (4.60±1.17 months), the difference was not statistically significant.

This finding matches well with studies by **Motargemizadeh *et al.*** [7], which identified recurrence rates of 13.3% in the argon laser group, and **Abd-Elkhalak *et al.*** [9], which discovered a recurrence rate of 20% in the laser-treated group against 50% in the control group.

However, our findings deviate from the results published by **Arish and Dakkali** [8] who observed no statistically significant difference in recurrence rates between groups treated with and without argon laser treatment (76% vs. 90%, p=0.16). This variance may be related to changes in approach, such as their use of a longer preoperative interval for laser treatment (three weeks before surgery), a larger mean number of laser spots, and a one-year follow-up period. Such variables might impact results and recurrence rates.

While the usefulness of argon laser treatment in decreasing recurrence is supported by multiple studies, it is vital to highlight that some, like **Arish and Dakkali** [8] concluded that laser therapy largely improves surgical field clarity rather than recurrence outcomes. The lack of a correlation between preoperative lesion size and recurrence rate highlights the need for more research into patient-specific laser efficacy factors.

Because all laser group participants received treatment one week before surgery, our study is consistent in laser use. Unlike **Arish and Dakkali** [8] who administered the laser three weeks preoperatively, this timing may explain recurrent results.

Laser treatment also improved pterygium length. In recurrent cases, the laser-treated group had significantly shorter pterygium length (1.82±0.30 mm) compared to the control group (2.36±0.42 mm, p=0.024). Laser treatment resulted in a greater reduction in pterygium length from pre- to post-treatment, with a mean difference of 1.40±0.28 mm compared to 0.60±0.28 mm in the control group (p=0.001). These findings suggest that laser treatment reduces recurrence rates and residual pterygium size more significantly.

Our study found a significant reduction in pterygium length on the cornea after treatment, which is consistent with **Abd-Elkhalak *et al.*** [9] who found shorter lengths in the laser-treated group post-recurrence (p<0.01). The coagulative and precise targeting of argon laser photocoagulation limit fibrovascular proliferation and improve surgical precision. A retrospective interventional study by **Cemil Apaydin *et al.*** [10] examined the efficacy of argon laser therapy as a primary modality and as an adjunct to surgical excision in 41 pterygia. All laser-treated groups showed statistically significant length reductions. These findings across studies support laser therapy's role in improving post-surgery structural outcomes.

After surgery, 30% of laser-treated patients and 40% of controls had irritative symptoms, although this difference was not statistically significant. The slightly lower prevalence in the laser-treated group may indicate better postoperative comfort from preoperative argon laser photocoagulation. Laser-treated eyes had significantly less irritative symptoms, according to **Cemil Apaydin *et al.*** [10]. Laser treatment reduces inflammation and tissue stress, which may explain these decreases.

Ahn *et al.* [11] conducted a retrospective study of 21 eyes treated with argon laser photocoagulation and 23 eyes treated with surgical excision to compare the efficacy and safety of argon laser photocoagulation for pinguecula management. We noticed less postoperative pain, as they found and showed significantly lower rates of conjunctival haemorrhage and scarring in their laser-treated group (0% vs. 34.8% and 4.8% vs. 30.4% respectively). These findings demonstrate that argon laser treatment may improve patient comfort and recovery characteristics. The research highly recommends preoperative argon laser photocoagulation for pterygium surgery. The results show that it reduces inflammation, recurrence, and residual pterygium size, which are crucial for surgical success.

STRONG POINTS

The study has several strengths that boost credibility and clinical relevance. First, the prospective, interventional, and randomized design minimises bias and provides strong evidence for comparisons between the two groups. Participant selection parameters including age and lack of systemic or ocular illnesses assure a homogenous research group. Few research have examined the effects of preoperative argon laser photocoagulation on pterygium recurrence, hence our study fills a need. This new approach has greatly improved pterygium surgery procedures and results.

The research also assesses recurrence rates, postoperative pterygium length, inflammatory indicators, and symptoms to evaluate the laser's effectiveness.

LIMITATIONS

Consider the study's shortcomings despite its positives. The very small sample size of 40 patients may restrict the generalizability of the results to wider, more varied groups. While 6-9 months is plenty to assess short-term results, it may not capture long-term recurrence or delayed problems. The single-center research may limit its application to different clinical situations or geographic locations. The study did not assess patient-reported outcomes like quality of life or satisfaction, which are increasingly considered important indicators of surgical success.

CONCLUSIONS

Our findings underscore the efficacy of preoperative argon laser photocoagulation as a valuable adjunct to the bare sclera surgical technique in managing pterygium. The current study demonstrated that preoperative argon laser photocoagulation significantly reduces pterygium recurrence rates and postoperative pterygium length while promoting faster resolution of inflammatory signs compared to the bare sclera technique alone. These findings underscore the efficacy of argon laser therapy as a valuable adjunct in pterygium surgery. The laser-treated group exhibited superior outcomes across multiple parameters, highlighting its potential to enhance both clinical and structural outcomes in patients undergoing pterygium excision. Clinicians should consider incorporating preoperative argon laser photocoagulation into standard pterygium surgical protocols to achieve better outcomes.

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