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## CASE REPORT

# Plasma technology instead of suture and glue in pterygium removal surgery with conjunctival rotational flap; A 1 year follow up Case report

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### Abstract

**Purpose:** To introduce a novel technique using PANIS method (Plasma assisted noninvasive surgery) in pterygium removal surgery with conjunctival rotation flap.

**Methods:** Two patients (1 male, 1 Female) with grade 3 and 4 of pterygium, based on SLIT2 grading system, underwent surgery with local anesthesia, removing pterygium tissue from cornea and also all related subtenon. Then surgeon used residual conjunctiva to cover bare sclera using rotational method. Fusion of the border of conjunctival flaps from nasal to superior occurred by plasma spots. UCVA, BCVA, OSDI and patient satisfaction were evaluated before, 1 month, 6 months and 1 year after the surgery, as well as 1 day and 1 week post-operation examinations included slit-lamp and external check-up that has been done by the surgeon.

**Results:** Patients with primary pterygium, underwent surgery with PANIS method. Last follow-up session in 1 year, showed significant improvement in astigmatism and 1 line in BCVA. There were no complications and side effects during and after the surgery and also other reported complication included diplopia in lateral gaze, granuloma and scarring was not observed and no recurrence have been seen in the follow-up period and patients were satisfied. Additionally 1 day and 1 week slit-lamp examination showed plasma spots caused good attachment of conjunctival tissue with ocular surface.

**Conclusion:** After treating 2 patients with PANIS method, it seems that plasma spots can be a good substitute for suture or glue in pterygium surgery with conjunctival rotational flap, because it's easy and fast way for fusing the conjunctival flap without any complication or side effect.

**Keywords:** Pterygium; Conjunctival rotation flap; Plasma; PANIS

**Introduction:**

Pterygium is a quasi-triangular and vascular epithelial which grows from nasal side of the eye to cornea<sup>1</sup>. The risk factors that cause pterygium growth could be genetic, age more than 50, UV radiation<sup>2</sup>, Outdoor occupation and rural living environment<sup>3</sup>, but the main reason remains actually elusive. Prevalence could be changed by the climate, from 9.1% in hilly regions to 20.3% in coastal regions<sup>4</sup>. Affected patients suffer from astigmatism, foreign body sensation, tearing and burning besides cosmetic disturbing that could reduce the quality of life<sup>5</sup>.

Pterygium surgery could be the treatment plan when patients complain about visual disturbance or cosmetic issues due to the fibrovascular tissue growth toward the cornea<sup>6</sup>. Many approaches for surgery has been conducted for less recurrence rate included using conjunctival autograft, amniotic membrane transplantation and conjunctival rotational flap fixed by suture or glue<sup>7</sup>. Considering disadvantages of fusion by suture and glue including, ocular irritation, foreign object in scar site of conjunctiva<sup>8</sup> and oculocardiac reflex stimulation<sup>9</sup>, Dr. F.N. introduced a novel technique using plasma, as the fourth state of matter, to fix amniotic membrane into conjunctiva border and they reported promising results with no recurrence in 4 cases in 2021<sup>10</sup>. They use PLEXR PLUS device (GMV Srl, Rome, Italy) as the plasma generator which is safety approved in animal phase by applying plasma spots on rabbit's conjunctiva and evaluating histopathological changes within 1-month and 6-month follow-up<sup>11,12</sup>. This technique became a novel

approach for treating conjunctivochalasis<sup>13</sup>, Conjunctival cysts<sup>14</sup>, pinguecula<sup>15</sup>, dry eye<sup>16,17</sup> (punctal occlusion with plasma spots), nevus<sup>18,19</sup>, concretion<sup>14</sup> and pterygium<sup>20</sup> in a safe, easy and office-based manner just by plasma spots. In the current study, we aim to demonstrate the efficacy of plasma spots instead of suture or glue for fusion of conjunctiva borders in rotational flap approach for pterygium surgery.

**Methods:****Case selection:**

2 patients were managed in Vision health research center, Tehran, Iran after explaining any possible side effects and recurrent in the consent form so that written informed consent was obtained from patients and Semnan Medical sciences university ethic committee approved this research, identified by (IR.SEMUMS.REC.1397.198).

First case is a 40 year-old man with primary pterygium grade 3, in his left eye. Case 2 is 60 years old woman with grade 4 of primary pterygium in her left eye. All grades are based on SLIT2 grading system which is divided pterygium into four groups (Table 1)<sup>21</sup>.

Table 1. SLIT2 pterygium grading system considering corneal and conjunctival parameters

	Grading	1	2	3	4
Corneal parameters	Stocker's line	None	Minimal: Similar to Hudson-Stahli line	Moderate: Moderately coloured pigment	line Dense: Deeply coloured/ elevated pigment line
	Length of head	0–15%	15.1–30%	30.1–50%	>50%
	Injection/ vascularity of head	Normal	Mild: Vessel congestion	Moderate: Vessel congestion with enlarged vessels	Severe: Vessel congestion with engorged vessels
	Thickness of head	Normal	Flat	Elevation < 1 mm	Elevation >1 mm
Conjunctival parameters	Size at limbus (in clock hours)	1	2	3	4
	Length of body	0–25%	25.1–50%	50.1–75%	75.1–100%
	Injection/ vascularity of body	Normal	Mild: Vessel congestion	Moderate: Vessel congestion with enlarged vessels	Severe: Vessel congestion with engorged vessels
	Thickness of body	Normal	Flat	Elevation < 1 mm	Elevation >1 mm

**Surgical technique:**

Local anesthesia was done in order to numb the eye with subconjunctival injection of lidocaine. Operation was performed by one surgeon (F.N.). Patients were told to gaze temporal with no need of cornea fixation with 7-0 Vicryl corneal traction suture. First head of the pterygium tissue was dissected from cornea and then all involved subtenon was excised and lifted away from the ocular surface. Thereafter the nasal residual conjunctiva angled and pulled toward the superior conjunctival border in a rotational pattern. This technique will avoid of bare sclera. Plasma spots were generated by PLEXR PLUS device (GMV Srl, Rome, Italy) to fuse the conjunctival borders without any

need of suture or glue (Table 2). Ultimately, antibiotic and steroid eye cream applied on the operated eye and pansemented with eye patch. (Figure 1 & Figure 2)

Table 2. Plasma generator (PLEXR PLUS) characteristics and technical features

Parameters	Values
Working gas	Air
Power supply	Docking station = 24 V, Handpieces: embedded inductive charger = 5 V
<b>Handpieces</b>	
Max output	≤ 2 W
Max working voltage	≤ 1.3 kVPP
Output frequency	(70–80) kHz
<b>Handpiece types</b>	
White	V peak to peak = 500 V, Power = 0.7 W, Frequency = 75 kHz
Green	V peak to peak = 600 V, Power = 1 W, Frequency = 75 kHz
Red	V peak to peak = 700 V, Power = 2 W, Frequency = 75 kHz
Maximum absorbed power (Docking station)	120 W
Applicator electrode	Stainless steel sterile disposable needle

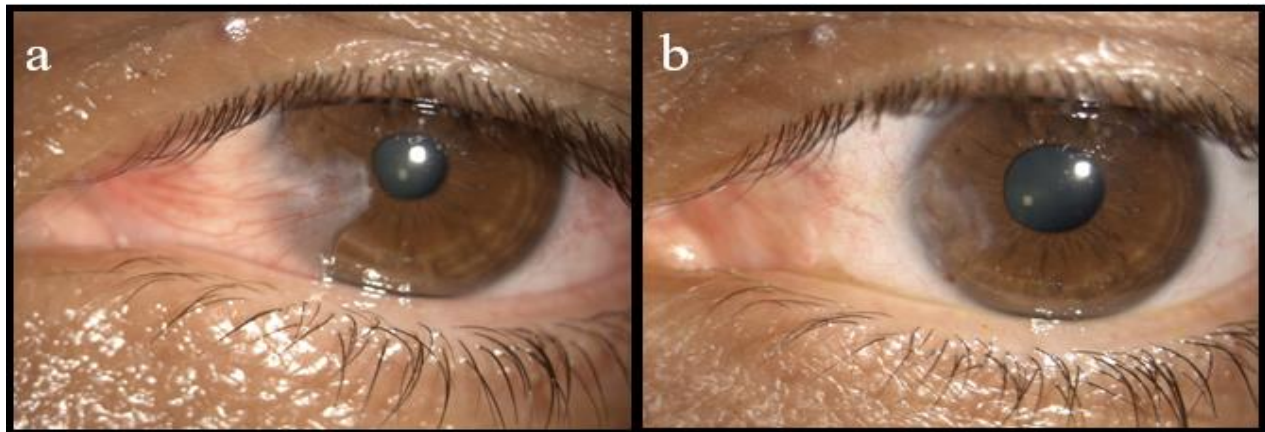


Figure 1. a. Before b. 1 year after pterygium surgery using conjunctival rotational flap with PANIS method (Case 1)

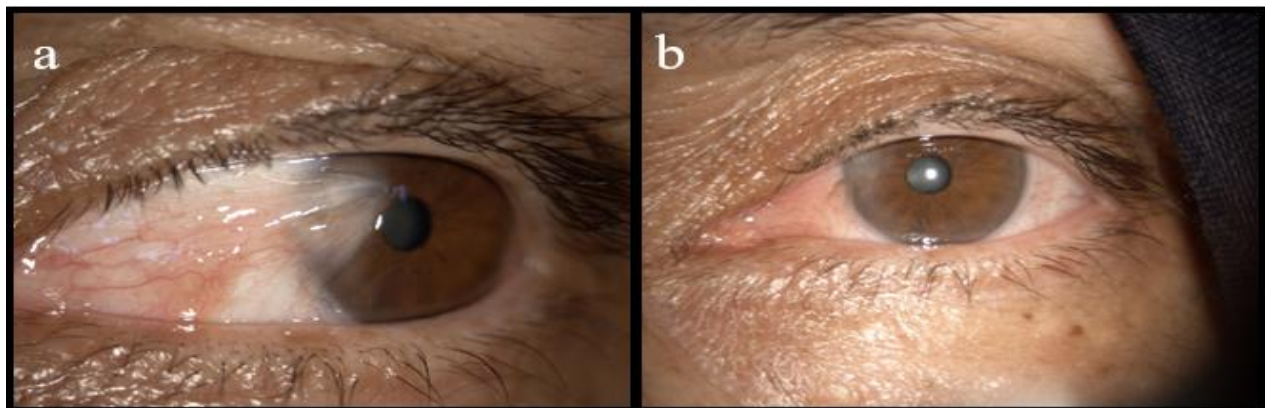


Figure 2. a. Before b. 1 year after pterygium surgery using conjunctival rotational flap with PANIS method (Case 2)

**Post-operative management and follow-up:**

After the surgery, patients was treated by antibiotic and corticosteroid. Ciprofloxacin eye drop was prescribed every 6 hour for 1 week, and also betamethasone eye drop started with every 4 hour for the first week and tapered off for 3 weeks.

Parameters included UCVA, BCVA, OSDI (Ocular Surface Disease Index) questionnaire were measured before, 1 month, 6 month and 1 year after the pterygium excision surgery. The OSDI is for measuring the patient's irritation in dry eye and in general it will conclude the symptoms and daily discomfort with quantification. The final score is ranged for 0 to 100, which categorizes into four groups depending on the severity of dry eye.

Patient's satisfaction and slit-lamp examination, any possible complication or side effect and recurrence were measured 1 day, 1 week and 1 year after pterygium removal surgery with this novel technique. Satisfaction of the patients were evaluated by two questions. First question is, if you have pterygium in your opposite eye, would you prefer to choose this novel method for your pterygium removal surgery. The second question is, would you tend to introduce this novel technique to any other family member of yours with pterygium. The answers should be in the range of 0 to 10 which is defined 0 for not satisfied and 10 for perfect satisfaction and has the variety range for any number from 0 to 10<sup>14</sup>.

**Results:**

Two patients with the age of 40 and 60 (1 male and 1 female) with grade 3 and 4 were included in our study. Both patient's pterygium tissue was nasally located. Both patients were complained about poor vision and cosmetic issues. Thus, they were underwent pterygium removal surgery with conjunctival rotational flap technique.

Corneal astigmatism had been improved significantly after the surgery which are indicated in Table 3. UCVA and BCVA were corrected for 1 line and patient's vision complaints totally solved.

The answers to our questions that we designed for evaluating satisfaction, were obtained and compared before and 1 year after the procedure. These answers showed, this new approach for pterygium removal surgery using PANIS method has reached perfect satisfaction in our patients. OSDI mean score before the surgery was 65.7 which became 8.4 after 1 year follow-up that is the sign of less symptoms in patients (Table 4).



Table 3. Patient's visual acuity and demographic characteristics

Demographic characteristics			Follow-up time	UCVA	Refraction			BCVA
					Sphere	cylinder	Axis	
Case 1	Male	OS	Before	7/10	+1.75	-5.25	175	8/10
			1 month	8/10	+1.50	-2.75	180	9/10
			6 month	8/10	+1.50	-2.75	180	9/10
			1 year	8/10	+1.25	-2.75	180	9/10
Case 2	Female	OS	Before	7/10	+3	-3.5	165	8/10
			1 month	9/10	+0.75	-1.0	170	9/10
			6 month	9/10	+0.50	-1.0	170	9/10
			1 year	9/10	+0.50	-1.0	170	10/10

Table 4. Evaluating patient's satisfaction

Follow-up time	Question 1		Question 2		OSDI	
	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
Before procedure	0	0	0	0	74.5	56.9
1 year After procedure	10	10	10	10	16.8	0

There were no complications during and after the surgery containing scar formation, diplopia and conjunctival detachment or any other possible side effects. No recurrence was seen after 1 year may attributed to the effect of sealing bare sclera and also it seems that using plasma spots instead of suture and glue can decrease the rate of recurrence whereas, case 2 had an abnormal growth of conjunctiva. Considering of stability and stop of the growing tissue before limbus in our 1 year follow-up, it is doesn't met the recurrence criteria.

In slit-lamp examinations after 1 day, 1 week and 1 year after surgery, there were no signs of serious sub-conjunctival hemorrhage, granuloma or any unusual pathology.

**Discussion:**

Pterygium is a fibrovascular tissue that emanates from caruncle and grows toward the cornea. This ocular surface disease effected 12% of people all over the world and it causes visual impairment and cosmetic problems so that patients will tend to have excision surgery<sup>22</sup>.

There are several techniques for pterygium removal surgery but we have discussed about three main approaches with low rate of recurrence and better post-operative results included using amniotic membrane, conjunctival autograft, and conjunctival rotational flap in order to avoid bare sclera. Our team evaluated these methods using plasma spots for fusion part of the surgery

instead of suture or glue in two different studies and reported the results. In current study we choose conjunctival rotational flap method.

In 1997, comparison of using amniotic membrane and conjunctival autograft with suture fusion, showed that autograft cause less recurrent percentage which is 4.9% and also more efficient vision with improving two lines in the Snellen chart<sup>23</sup>. But with techniques improvement in 2021, use of conjunctival autograft demonstrate none recurrence versus amniotic membrane<sup>24</sup>.

Conjunctival autograft and conjunctival rotational flap manifests same rate of recurrence, however low incidence of flap edema in conjunctival rotation flap will increase the chance of using it for pterygium excision method<sup>25,26</sup>.

It is good to be noted that position and method of suturing in conjunctival rotation flap has been a challenge to be leading an effective surgery with less post-operative recurrence and complication<sup>27</sup>. In case of using 10-0 nylon or 8-0 silk sutures, wound dehiscence<sup>28</sup> and ocular irritation<sup>29</sup> may be seen as a disadvantage of suturing. Furthermore use of fibrin glue enforce much more cost for hospital and patients.

Paraskevi T. used dry amniotic membrane for pterygium excision without any need of suture and glue, thereafter fixed this tissue by bandage contact lens. They reported no recurrence or any complication during 4-month follow-up and claimed, operation time will be shorter and all the procedure will be

well tolerated by patients<sup>30</sup>. Another research in 2023 indicated that using cryopreserved Amniotic membrane could be an effective method with 2.3% recurrence rate and significant improvement in BCVA, in 582 eyes without any need for suture or glue<sup>31</sup>.

In recent years plasma technology has been admitted in many medicinal fields. Cold atmospheric plasma generators have been used in ophthalmic field for many reasons such as ocular surface disease and infection treatment. This device has been safety proved with two animal phase studies. In pterygium removal surgery Nejat et.al used plasma spots for fusing all free conjunctival borders and reported 2 recurrences from 6 patients<sup>20</sup>. In another study plasma spots fused the amniotic membrane to conjunctival border and resulted no recurrence in 4 patients<sup>10</sup>.

In current study, we are reporting a sutureless and glueless pterygium surgery using atmospheric low temperature plasma generator, which can also treat more than 15 ocular surface diseases.

As previously mentioned, in our method, two patients were met our inclusion criteria and surgeon removed all involved subtenon tissue and fused borders of residual conjunctiva from nasal to superior to avoid recurrence considering facts that clear recurrence happen in a gap of bare sclera. Nejat et al. team was evaluated the inflammatory responses in rat model with measuring the concentration of candidate cytokine responses and proved there is no stable inflammatory factors<sup>32</sup>. Considering this plasma generator as a multitask device for

treating more than 15 ocular surface diseases, it is a cost-benefit approach beside other advantages included being safe, office-based, easy to learn, effective and fast for treatment. It is good to be noted that other researches with large number of patients and longer follow-up needed for a better reassurance. Future clinical trials will help to reach more reliable and promising results.

**Conclusions:**

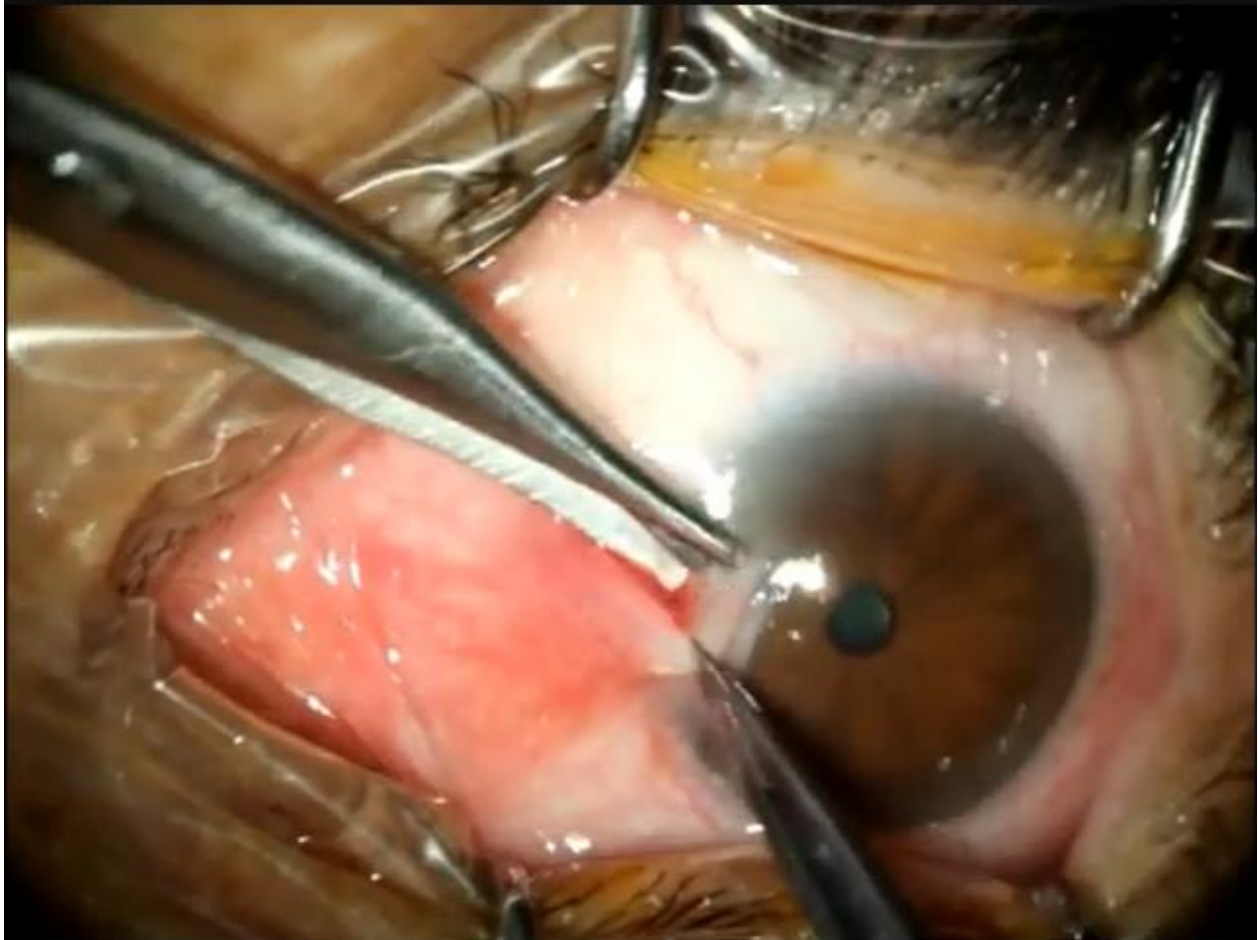
PANIS is a simple and effective method for pterygium removal surgery with conjunctival rotational flap because of the good fusion mechanism of the plasma spots and shortening the time of the surgery.



**Surgery Technique Video:**

To view the surgical technique video, please [click here](#) or follow the link below:

<https://www.aparat.com/v/hkHpQ>.



[Surgery Technique | Plasma Tech instead of suture & glue in pterygium removal surgery](#)

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**Conflicts of Interest Statement:**

No Conflicts.

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