

## Case Report

# Management of Diathermy-Induced Corneal Burn following Upper Eyelid Blepharoplasty with Multilayer Amniotic Membrane Transplantation: A Case Report and Review of the Literature

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## Keywords

Amniotic membrane transplantation · Corneal injury · Corneal thermal burn · Diathermy-induced corneal burn

## Abstract

**Introduction:** Thermal injuries associated with cosmetic eyelid surgery can significantly impair corneal integrity, potentially leading to vision loss. Conventional management, including bandage contact lens use, topical steroids, lubrication, autologous serum tears, and vitamin C, plays a crucial role in preventing long-term complications. This case report explores the potential benefits of multilayer amniotic membrane transplantation (AMT) as an adjunct to standard therapy for treating diathermy-associated corneal burns. Review of the literature advocates the beneficial effects of supplementary AMT in managing thermal corneal trauma.

**Case Description:** A 75-year-old man presented with unilateral diathermy-associated corneal laceration superior to the visual axis following cosmetic blepharoplasty. Vision had deteriorated from his baseline 20/30 to 20/125 postoperatively. Intervention involved multilayer AMT alongside standard care, including topical steroids and antibiotics, oral doxycycline, and vitamin C. Postoperative course was monitored with anterior segment optical coherence tomography (AS-OCT) imaging. By 3 months, complete corneal healing and restoration of baseline visual acuity were achieved. **Conclusion:** This is the first documented case of multilayer AMT as an effective supplement to conventional management of diathermy-associated corneal injury. While AMTs unique properties likely contributed to corneal healing and visual recovery, the results should be interpreted in the context of a multimodal therapeutic approach.

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## Introduction

Blepharoplasty is the surgical procedure of choice for both esthetic enhancement and functional improvement of the periorbital region. While generally considered safe and well-tolerated, the procedure can occasionally lead to iatrogenic ocular complications such as infection, vision loss due to retrobulbar hemorrhage, globe perforation, scarring, exposure keratopathy, and corneal abrasions [1].

Thermal corneal injury secondary to blepharoplasty, albeit rare, can lead to significant corneal damage and vision loss [2]. The prognosis of this sight-threatening intraoperative complication depends largely on the severity of the acute trauma and the subsequent treatment plan [2]. Immediate management is crucial to address the compromised stromal tissue and overlying epithelial defect, aiming to prevent chronic stromal opacity, scarring, and long-term vision impairment. Recommended therapeutic strategies for thermal corneal trauma in the context of cosmetic blepharoplasty include use of bandage contact lenses, topical and oral antibiotics, topical steroids, lubrication, autologous serum eyedrops, and vitamin C [2, 3].

Amniotic membrane transplantation (AMT) has proven effective in managing both chemical and thermal corneal burns [4]. The amniotic membrane, the innermost layer of the placental membrane, possesses unique biological properties that enable it to serve as a therapeutic bandage, supporting and restoring the compromised corneal surface [4]. AMT is a validated treatment modality that facilitates epithelialization, suppresses inflammation, and prevents corneal scarring and chronic visual morbidity [4, 5].

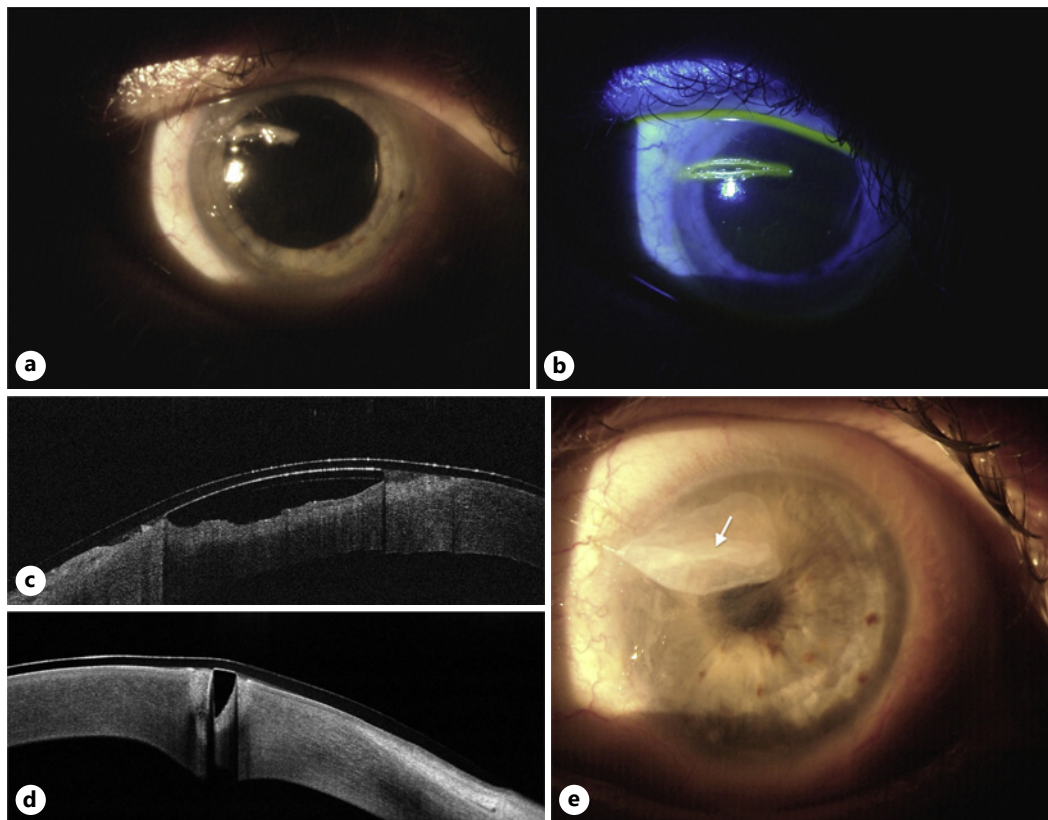
Herein, we present a case of multilayer AMT, as an adjunct to traditional treatment, following extensive thermal corneal injury secondary to cosmetic blepharoplasty that required immediate repair. The aim was to alleviate pain, ensure proper epithelial healing, and restore visual performance. The surgical technique of multilayer AMT is detailed. Slit-lamp bio-microscopy and anterior segment optical coherence tomography imaging are provided and delineate the postoperative progress. Finally, a review of existing literature displays the extensive risks of such injuries and evaluates the outcomes of conventional treatments.

## Case Presentation

A 75-year-old man presented with persistent pain and blurry vision in the right eye 1 day after undergoing cosmetic bilateral upper eyelid blepharoplasty. The procedure, performed by a general plastic surgeon using a lipolytic diathermy technique, did not include the use of a protective corneal shield. Examination revealed a 6 mm long and 0.6 mm wide, about 50% thick corneal laceration, accompanied by an overlying epithelial defect. The laceration was located superior to the visual axis (Fig. 1). The linear thermal burn was caused intraoperatively by the cautery tip of the diathermy unit. No limbal or conjunctival involvement was identified. At presentation, the patient's vision had deteriorated to 20/125 from his baseline of 20/30. Multilayer AMT was performed to relieve pain, ensure proper epithelialization, and restore visual acuity.

### *Surgical Technique*

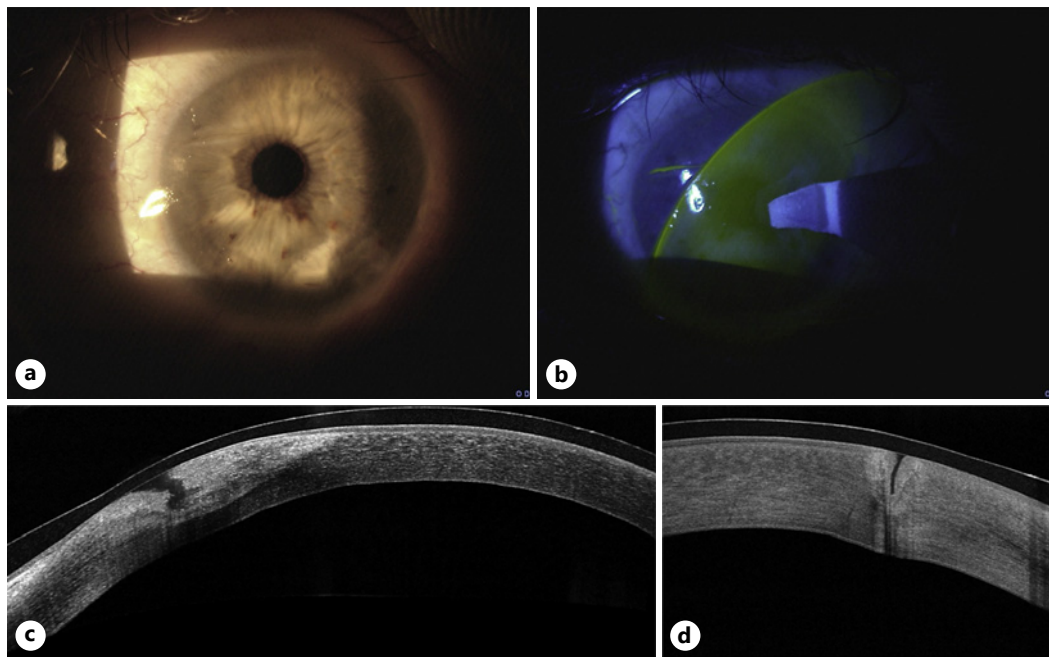
Surgery was performed under local anesthesia. The epithelium around the area of the laceration was mechanically debrided (approximately 2–3 mm on each side) to allow for better adherence of the amniotic membrane. Initially, a small piece of amniotic membrane tissue was placed inside the wound cavity to fill the gap. Subsequently, a larger piece of amniotic membrane measuring 6 mm × 4 mm was then applied to the recipient eye as a patch,



**Fig. 1.** Slit-lamp photographs and anterior segment optical coherence tomography cross-sectional images of the patient's right eye at presentation and slit-lamp photograph of the same eye 1 day after repair of the thermal corneal burn. **a** Overview of the 6 mm long and 0.6 mm wide thermal corneal burn in the right eye, located superior to the visual axis. **b** Slit-lamp biomicroscopy with fluorescein staining shows the extensive laceration accompanied by an overlying epithelial defect. **c, d** AS-OCT reveals the partial-thickness corneal trauma and opacification, as imaged on horizontal and vertical cuts, respectively. **e** Two pieces of amniotic membrane were placed, one small piece to fill the gap (white arrow) and a larger piece on top as a patch. Both were secured in place with tissue glue and a bandage contact lens.

covering the entire damaged area with the epithelial surface facing up (Fig. 1e). Both grafts were stabilized using fibrin glue and a bandage contact lens (Kontur 16 mm, Kontur Kontakt Lens Co., Inc., Hercules, CA, USA) was placed on top. While the risk of postoperative amniotic membrane sloughing is generally higher with fewer layers, a third larger layer was not added in this case. This decision was made to avoid completely obstructing the visual axis, as this was the patient's better-seeing eye. The patient received topical steroids (preservative-free dexamethasone 1 mg/mL, 4 times a day), which were slowly tapered over 3 months, prophylactic antibiotic drops (moxifloxacin twice a day), oral doxycycline (100 mg twice a day for 6 weeks, then once a day for another 6 weeks), and vitamin C (1,000 mg twice a day for 6 weeks, then once a day for another 6 weeks) for 3 months.

At each postoperative visit, ocular examination included assessments of visual acuity, slit-lamp biomicroscopy with fluorescein staining, and anterior segment optical coherence tomography imaging to monitor progress. At the patient's 3-week follow-up visit, examination revealed significant wound epithelialization, integration of the amniotic membrane into the corneal stroma and concurrent improvement in visual acuity to 20/60 (Fig. 2). By 3 months, due to re-epithelialization of the integrated amnion remarkable wound healing was



**Fig. 2.** Slit-lamp photographs and anterior segment optical coherence tomography (AS-OCT) cross-sectional images of the patient's right eye 3 weeks after multilayer amniotic layer transplantation. **a** Significant wound epithelialization is observed on slit lamp examination. **b** Upon sliding the bandage contact lens on the side, slit-lamp biomicroscopy with fluorescein staining shows significant closure of the epithelial defect. **c, d** AS-OCT imaging reveals integration of the amniotic membrane into the corneal stroma along with remarkable wound healing on horizontal and vertical cuts, respectively.

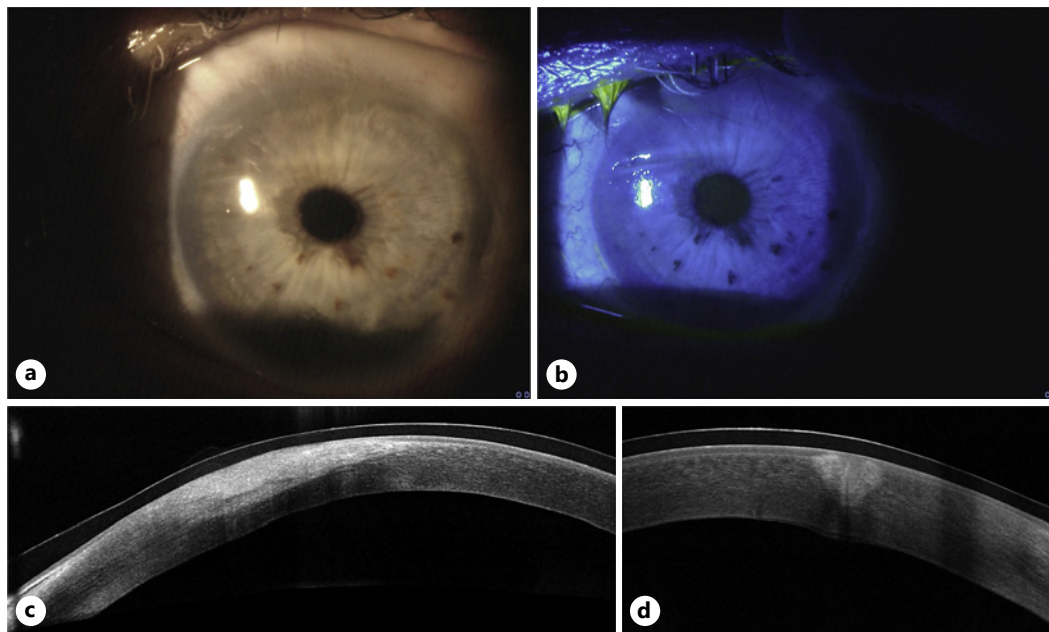
observed, along with complete restoration of the corneal epithelium with no residual defect (Fig. 3). The patient's vision returned to his 20/30 baseline, and the bandage contact lens was removed.

## Discussion

Thermal injuries in the context of cosmetic eyelid surgery can significantly compromise corneal integrity and lead to vision loss [2]. During blepharoplasty, the eyes remain closed and the eyeballs move upwards due to Bell's phenomenon, making the exact position of the underlying cornea difficult to determine. This can result in accidental cauterization of the cornea, leading to stromal tissue loss, epithelial defects and decreased visual acuity. Therefore, early and appropriate management is of extreme importance to save the patient's eye and sight.

The incidence of thermal corneal injury as a complication secondary to blepharoplasty is rare, with only 10 cases reported in the literature [2, 3, 6–9], as summarized in Table 1. Patients were both male (20%) and female (80%) with a mean age of 53.3 years (range, 42–68 years). Most cases involved standard diathermy bilateral upper eyelid blepharoplasty, with one case involving radiofrequency-assisted bilateral upper eyelid blepharoplasty and one case CO<sub>2</sub> laser-assisted bilateral upper and lower eyelid blepharoplasty. Corneal protection during the procedure was used in only 1 of the 4 cases that specifically commented on this. All patients had unilateral corneal involvement, with the right eye affected in 4 cases and the left eye in 6 cases. The onset of symptoms ranged from immediate to 1 week post-surgery, with presentation to ophthalmology occurring between 1 day and 6 weeks following symptom onset. Blepharoplasty-





**Fig. 3.** Slit-lamp photographs and anterior segment optical coherence tomography (AS-OCT) cross-sectional images of the patient's right eye 3 months after multilayer amniotic layer transplantation. **a** Slit-lamp examination shows complete wound healing with minimal scar formation. **b** Fluorescein staining reveals full closure of the epithelial defect. **c, d** AS-OCT monitoring shows complete restoration of the diathermy-induced corneal wound with superficial scarring as imaged on horizontal and vertical cuts, respectively.

associated thermal injuries included both partial and full-thickness central or paracentral lacerations, epithelial defects, stromal opacities, ocular hypotony and induced astigmatism. Post-blepharoplasty visual acuity was disclosed in 5 cases ranging from 20/25 to 20/800.

Following diagnosis, therapeutic management has included use of bandage contact lens, topical and oral antibiotics, topical steroids, lubrication, autologous serum eyedrops, and vitamin C [3, 4, 7, 9]. Surgical repair with the use of corneal sutures in 4 of the cases resulted in poor postoperative visual acuity ranging from 20/50 to 20/150 [2, 3, 7]. Implementation of cyanoacrylate glue in another case resulted in unimproved visual acuity of 20/200, even with a rigid contact lens fitting, establishing a diagnosis of functional vision loss [9]. Thus, traditional surgical approach with wound suturing or surgical glue at the corneal burn site may be associated with higher irregular astigmatism and poor wound healing due to distortion of the charred corneal tissue. Resolution of symptoms was noted in only one case. Residual astigmatism and corneal scarring were reported in the majority of cases (90%), indicating the limitations of conventional management in the treatment of blepharoplasty-induced corneal burns. Following treatment, most patients (60%) were ultimately referred for rigid contact lens fitting. One patient was eventually managed with astigmatic keratotomy. Deep anterior lamellar keratoplasty was contemplated in one case. The severity of the injury is a key factor in determining visual outcomes, with milder injuries typically leading to more favorable results, regardless of the treatment approach.

This report is the first in the literature to describe the use of multilayer AMT alongside traditional treatment for managing blepharoplasty-associated thermal corneal trauma. While AMT likely contributed to the observed improvements, the therapeutic regimen – including topical steroids, topical antibiotics, oral doxycycline, and vitamin C – was a critical component of the overall management. This comprehensive intervention and patient compliance led to resolution of all signs and symptoms at the patient's 3-month follow-up visit.

**Table 1.** Blepharoplasty-associated corneal thermal injury in the reviewed literature

| Reports                    | Patient age, gender | Eye | Prior eyelid surgery                  | Symptom onset | Time to presentation following symptom onset | Use of corneal shield | Type of injury                                                                                | Initial visual performance | Treatment                                                                                                   | Outcome                                                                                                                                             |
|----------------------------|---------------------|-----|---------------------------------------|---------------|----------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Meyer BI et al. [2] (2024) | 48 y/o female       | OD  | Bilateral upper eyelid blepharoplasty | Immediate     | 2 weeks                                      | No                    | 0.5 mm-wide thick central cavitation, epithelial defect, stromal haze, induced astigmatism    | 20/800                     | Topical antibiotics<br>Topical steroids (20/800) at 2 weeks<br>Lubrication<br>Oral doxycycline<br>Vitamin C | Epithelialization unimproved vision (20/800) at 2 weeks<br>Referral for rigid contact lens fitting<br>Potential deep anterior lamellar keratoplasty |
|                            | 44 y/o female       | OS  | Bilateral upper eyelid blepharoplasty | 1 week        | 1 week                                       | Not reported          | 7-mm oblique full-thickness corneal laceration, shallow anterior chamber, lens opacifications | Counting fingers           | Surgical repair with 10-0 nylon sutures<br>Perioperative antibiotics                                        | Residual central stromal scar at 6 weeks<br>Lens opacities<br>Visual acuity of 20/50 improved to 20/30 with a rigid Contact lens                    |
|                            | 54 y/o male         | OD  | Bilateral upper eyelid blepharoplasty | Immediate     | 4 weeks                                      | Not reported          | 3-mm full-thickness paracentral corneal laceration, Descemet membrane folds                   | 20/400                     | Surgical repair prior to presentation<br>Topical antibiotics<br>Topical steroids                            | Visual acuity of 20/80 at 4 weeks<br>Future removal of sutures<br>Potential contact lens evaluation                                                 |

**Table 1** (continued)

| Reports                  | Patient age, gender | Eye                                             | Prior eyelid surgery                                          | Symptom onset | Time to presentation following symptom onset | Use of corneal shield                                                                  | Type of injury                                                                     | Initial visual performance | Treatment                                                                                           | Outcome                                                                                                                            |
|--------------------------|---------------------|-------------------------------------------------|---------------------------------------------------------------|---------------|----------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Bonte et al. [3] (2024)  | 55 y/o female       | OS                                              | Bilateral upper eyelid blepharoplasty                         | 1 day         | 1 day                                        | Not reported                                                                           | 1.5 × 0.6 mm central stromal opacity, stromal thinning overlying epithelial defect | 20/100                     | Bandage contact lens<br>Topical antibiotics<br>Autologous serum eyedrops                            | Epithelialization residual central stromal scar<br>Visual improvement with scleral lens at 2 months                                |
| 46 y/o male              | OS                  | Bilateral upper and lower eyelid blepharoplasty | 1 day                                                         | 1 day         | Not reported                                 | 5.5 mm full-thickness central corneal laceration, corneal opacification, hypotonic eye | Hand movements                                                                     |                            | Corneal sutures<br>Intracameral and topical antibiotics<br>Topical steroids<br>Bandage contact lens | Residual irregular astigmatism at 6 months<br>Visual acuity of 20/100 (with pinhole) improved to 20/25 with a scleral contact lens |
| 51 y/o female            | OS                  | Bilateral removal of upper eyelid papillomas    | Immediate                                                     | Not reported  | Not reported                                 | Not reported                                                                           | Partial-thickness temporal corneal lesion                                          | 20/25 (with pinhole)       | Bandage contact lens<br>Topical antibiotics                                                         | Significant healing of the lesion<br>Visual acuity of 20/20 with glasses                                                           |
| Mangan M 2021 [6] (2021) | 68 y/o female       | OS                                              | Radiofrequency-assisted bilateral upper eyelid blepharoplasty | Immediate     | 1 day                                        | No                                                                                     | 2–3 mm penetration in the superior paracentral region                              | Not reported               | Bandage contact lens<br>Topical antibiotics                                                         | No symptoms or vision loss at 1 month                                                                                              |

**Table 1** (continued)

| Reports                                      | Patient age, gender | Eye | Prior eyelid surgery                                                  | Symptom onset | Time to presentation following symptom onset | Use of corneal shield | Type of injury                                                                                                 | Initial visual performance | Treatment                                                                          | Outcome                                                                                                                                  |
|----------------------------------------------|---------------------|-----|-----------------------------------------------------------------------|---------------|----------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Shoji et al. [7] (2020)                      | 64 y/o female       | OS  | Bilateral upper eyelid blepharoplasty                                 | 1 week        | 1 week                                       | No                    | 8-mm linear partial-thickness central corneal laceration                                                       | 20/400                     | Surgical repair with 10-0 nylon sutures                                            | Residual irregular astigmatism<br>Faint corneal scar at 3 months<br>Visual acuity of 20/150<br>Referral for scleral contact lens fitting |
| Darlington et al. [9] (2006)                 | 61 y/o female       | OD  | Bilateral upper and lower eyelid CO <sub>2</sub> laser blepharoplasty | 1 day         | Not reported                                 | Yes                   | 2 Seidel-positive corneal defects in the paracentral cornea, Descemet membrane folds, shallow anterior chamber | Counting fingers           | Cyanoacrylate glue bandage contact lens<br>Topical antibiotics<br>Topical steroids | Epithelialization residual stromal scars<br>Best-corrected visual acuity of 20/200                                                       |
| Chou and Boxer Wachler [8] (2001)            | 42 y/o female       | OD  | Cosmetic blepharoplasty                                               | Not reported  | 6 weeks                                      | Not reported          | Corneal penetration, induced astigmatism                                                                       | Not reported               | Topical antibiotics<br>Topical steroids                                            | Reduction of astigmatism after astigmatic keratectomy                                                                                    |
| y/o, years old; OD, right eye; OS, left eye. |                     |     |                                                                       |               |                                              |                       |                                                                                                                |                            |                                                                                    |                                                                                                                                          |



Human AMT has been effective in restoring epithelial defects and treating sterile ulcerations of various origins [10]. The amniotic membrane acts like a basement membrane, facilitating the migration of corneal epithelial cells [10]. Its antibacterial properties may also minimize infection [5]. The lack of human leukocyte antigens eliminates the possibility of immune-mediated amniotic membrane graft rejection, negating the need for immunosuppressive treatment [5]. Additionally, AMT is thought to inhibit scarring by downregulating certain fibroblast activity and transforming growth factors involved in tissue proliferation and differentiation [4]. These properties likely contributed to the complete corneal reconstruction observed in our case.

Previous studies have primarily used standard therapeutic methods to treat blepharoplasty-related corneal thermal injuries [2, 3, 6–9], often resulting in chronic scarring and poor visual outcomes and necessitating scleral contact lens fitting or surgical correction to improve vision (Table 1). In our case, multilayer AMT served as a protective and nourishing dressing over the corneal wound, displaying remarkable healing properties with complete restoration of visual performance at 3 months. While AMT likely contributed to the positive outcome, it is essential to recognize that the combination of treatments, including traditional therapies such as the use of a bandage contact lens, steroids, antibiotics, vitamin C, and doxycycline, played an integral role. Furthermore, the lack of a control arm and the paracentral location of the lesion represent limitations, making it challenging to attribute the results solely to AMT. Our approach may be particularly beneficial in select cases with specific characteristics, such as superficial lacerations located away from the visual axis, but it is not necessarily applicable to all thermal injuries. In conclusion, our case highlights the potential benefits of AMT as part of a multimodal treatment strategy rather than as a standalone solution. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see <https://doi.org/10.1159/000543760>).

### Statement of Ethics

Ethical approval is not required for this study in accordance with local or national guidelines. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images.

### Conflict of Interest Statement

S.P. is a consultant for Alcon. K.B. has no financial disclosures to report.

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### Author Contributions

Konstantina Bachtalia and Sotiria Palioura equally contributed to the study conception, design and commented on previous versions of the manuscript and read and approved the final manuscript.

## Data Availability Statement

The data that support the findings of this study are not publicly available due to their containing information that could compromise the privacy of research participants but are available from the corresponding author S.P.

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