Case Report

Management of Corneal Melting after Keratoprosthesis: A Case of Successful Corneal Patch Graft and Review of Management Strategies

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Abstract

Corneal melting is a vision-threatening complication after keratoprosthesis (KPro) surgery, potentially leading to KPro extrusion and visual loss. A 37-year-old man with severe ocular and facial thermal burns underwent multiple lid reconstruction surgeries, culminating in KPro surgery. Corneal melting occurred adjacent to the optical cylinder, necessitating a corneal patch graft. Postoperatively, corneal thinning and the epithelial defect improved significantly. Rigorous monitoring and a tailored treatment regimen were crucial for optimal healing and the prevention of further complications. It seems that proactively patching areas of KPro corneal melting and optimizing ocular surface status is imperative. This approach may potentially obviate the need for more aggressive interventions, such as repeat KPro procedures.

Keywords: Keratoprosthesis; KPro; Artificial Cornea; Corneal Melting; Complication; Case Report.

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Introduction

Corneal melting after Boston type-I Keratoprosthesis (KPro) can cause KPro extrusion, major visual impairment, and visual loss. Its incidence is reported to be around 14- 16 % after KPro, with higher rates in patients with severe preexisting ocular surface disease or previous surgeries [1, 2]. Corneal melting after Boston type-I Keratoprosthesis can lead to retroprosthetic membrane formation, infectious keratitis, and dellen, with incidences of 31 %, 25 %, and 13 %, respectively, in melting cases [3].

Persistent corneal epithelial defects after KPro can lead to melting. However, patients who have undergone prior ocular surface reconstruction, such as limbal stem cell transplantation, show a reduced risk of corneal melting. This underscores KPro's efficacy in treating bilateral limbal stem cell deficiency resulting from ocular burns [4-8].

Corneal melting after KPro may be influenced by factors such as suboptimal surgical techniques and insufficient postoperative care. Vigilant monitoring after implantation is crucial to prevent risks leading to corneal melting [3]. Managing corneal melting in KPro patients requires an interdisciplinary approach, focusing on early diagnosis, timely intervention, and thorough follow-up for effective treatment [1, 3].

Treatment for corneal melting includes medical therapy with antibiotics, antifungal agents (if indicated), and TNF-α inhibitors like topical infliximab [1-3]. Surgical options include amniotic membrane transplantation, corneal patch grafting, tectonic lamellar keratoplasty, tectonic corneal transplantation, and KPro explantation and exchange [1-3]. Management strategies, including Boston KPro repair versus removal or exchange, have been evaluated in a retrospective study comparing their outcomes [1]. The choice of management depends on the severity of corneal melting, underlying etiology, and the patient's overall health [2].

Here, we report a case of corneal melting after KPro, focusing on the successful management achieved through a surgical corneal patch graft.

Case Presentation

The study protocol was reviewed, and the need for ethics approval was waived by the Ethics Committee of Shahid Beheshti University of Medical Sciences. Written informed consent was obtained from the patient for the publication of the details of the case and any accompanying images.

A 37-year-old man, 17 months after successful KPro surgery, presented with mild ocular discomfort and reduced visual acuity for one week. He had undergone multiple lid reconstructions following a severe thermal burn five years earlier, which resulted in vision loss in his right eye. Attempts to restore vision in his left eye included keratolimbal allograft and penetrating keratoplasty, but after limbal stem cell transplantation failure, he underwent KPro surgery.

The follow-up course was uneventful until he developed sclerocorneal melting in the inferior quadrants, which was treated with a sclerocorneal patch graft a year ago. His best-corrected visual acuity reduced from 20/200 to counting fingers at 2 meters on the Snellen chart.

Six months later, a new area of corneal melting and thinning occurred in the superior quadrant, adjacent to the KPro cylinder (Figure 1). His bandage contact lens had been lost for an unknown duration. The area was avascular with an epithelial defect, stromal melting, and thinning, but there was no leakage or titanium

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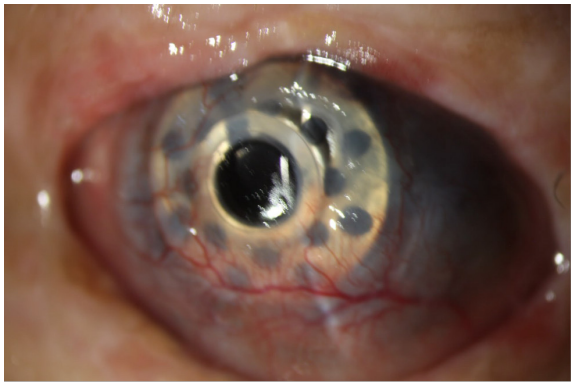

Figure 1: Preoperative slit-lamp image of the patient shows an area of corneal melting and significant thinning extending from 12 to 3 o'clock (indicated by the arrow). The melted area corresponds to the avascular region

back-plate exposure. Tactile intraocular pressure was between 10-15 mmHg. Fundus examination revealed a normal optic nerve with a cup-to-disc ratio of 0.6. The patient underwent a sectoral tectonic corneal patch graft.

During surgery (Figure 2), the melting area was marked and measured. The donor corneal lamella was then tailored from a preserved cornea-scleral rim on a Barron Artificial Anterior Chamber (Katena, Denville, NJ). Partial trephination of the donor using a vacuum trephine set at 350 microns depth was performed.

A 3-mm dermatomal punch was performed to trephine the central corneal lamella, shaping the periphery to match the melting quadrant. The peripheral cornea was positioned over the refreshed lamellar area and sutured in place with 10-0 nylon. Tarsorrhaphies were repeated and extended. At the conclusion, subconjunctival betamethasone 4 mg and

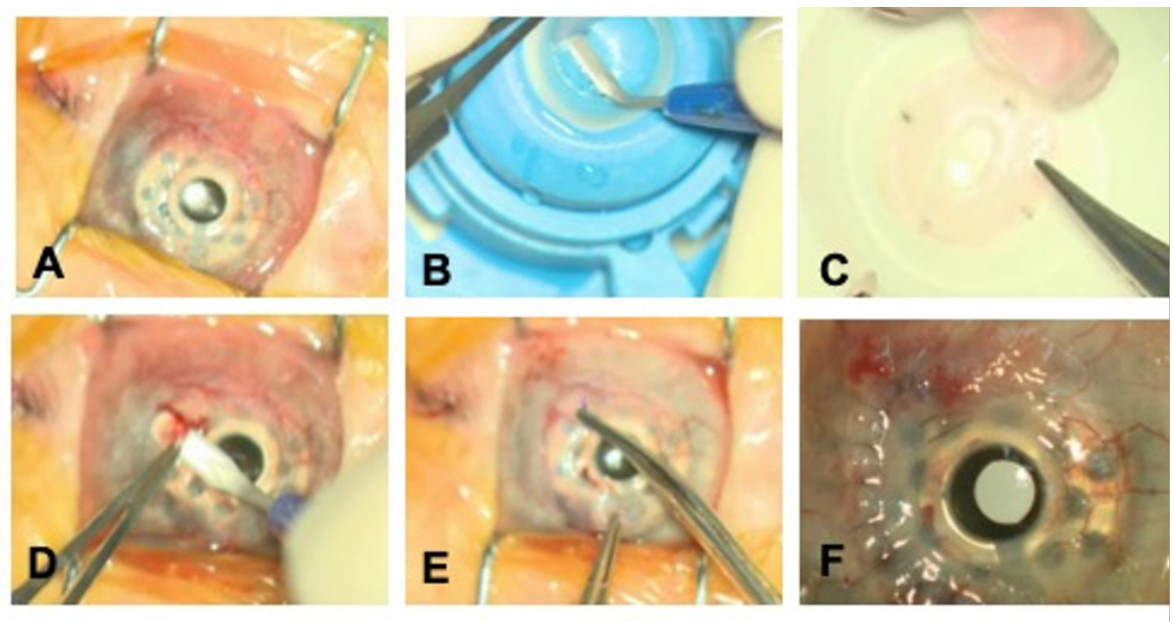

Figure 2: The surgical steps in corneal patch grafting. The melted area starts from the avascular region of the limbus with an approximate extension at 3 o'clock. (A) The donor cornea was placed on an artificial anterior chamber, and then partial trephination was performed using a vacuum trephine to a depth of 350 microns. (B) The corneal lamella was meticulously removed and placed on a Teflon block. (C) A 3-mm dermatomal punch was performed to trephine the central part of the corneal lamella. (D) Lamellar dissection of the melted area was performed using a crescent knife. (E) The peripheral portion of the donor cornea was shaped to match the melting quadrant, and then the corneal button was positioned over the lamellar area, with the borders tightly sutured using 10-0 nylon. (F) The final postoperative image is shown in

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cefazolin 100 mg were administered (All surgical procedures were performed by F.K.).
After five days, the epithelial defect improved and closed completely, with no residual defect. The patient was monitored daily and received preservative-free levofloxacin drops, daily non-preserved steroids (NPS), frequent preservative-free artificial tears (Artipic, Sina Darou, Tehran, Iran), and lubricants.
Six months after surgery, the patient showed improved and intact epithelium during follow-up visits. Adhering to treatment, there has been no recurrence of epithelial defect, stromal thinning, or tissue loss.

Discussion

The pathogenesis of corneal graft melting after KPro is complex, involving excessive corneal exposure, uncontrolled ocular surface tear film distribution and dryness, immune-activated responses, and/or infection [2, 10, 11]. Corneal melting results from stromal thinning, which can potentially lead to aqueous leakage, hypotony, endophthalmitis, retinal detachment, choroidal hemorrhage, and prosthesis extrusion [1]. Autoimmune diseases such as Stevens-Johnson syndrome, toxic epidermal necrolysis syndrome, and mucous membrane pemphigoid increase the risk of corneal melt, leak, and extrusion after KPro. The pathophysiology of corneal melting is linked to these conditions, suggesting a connection between immune responses and corneal integrity after KPro [12].
The development of retroprosthetic membrane, infectious keratitis, inflammatory disorders, and severe dryness is associated with a higher risk of corneal melt in KPro patients. The incidence of corneal melt after KPro increases to 14-16 % in patients with preexisting ocular surface disease or multiple surgeries [1, 3, 13]. Consistent with previous studies, our patient had undergone multiple lid reconstructions following a severe thermal burn, which contributed to the development of corneal melting [4]. The failure of limbal stem cell transplantation led to KPro surgery as a final option. Advances in the management of corneal melt, along with improvements in KPro design and postoperative care, have reduced its incidence. The use of ex vivo crosslinked cornea tissue as a carrier has been reported as a preventive measure against corneal melt in high-risk patients [12, 14].
Our patient initially presented with mild ocular discomfort and reduced visual acuity. Slit-lamp examination revealed corneal melting adjacent to the KPro cylinder, characterized by an avascular area with an epithelial defect and stromal thinning. The bandage contact lens, which plays a protective role against epithelial defects and melting, was missing. Typically, melting complications in KPro patients with limbal-conjunctival deficiency occur around 11 months postoperatively [15]. In our case, however, it occurred at 12 and 17 months after the KPro procedure.
Repeat KPro is reported as a method with a lower risk of melt recurrence and longer implant survival compared to KPro repair [1, 9]. However, no significant difference in complications or visual acuity has been reported between the two approaches [1]. We opted for repair and patching of the melted area, preserving the primary KPro as a less aggressive method. The successful management of corneal melting in our case highlights the importance of early detection and prompt intervention, consistent with findings from other studies [1, 3]. The corneal patch graft effectively addressed our patient's extensive corneal melting. The choice of management depends on the severity and extent of melting, underlying etiology,

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and patient health. Medical therapy with antibiotics, antifungal agents (if indicated), and TNF-α inhibitors are suggested as alternatives or adjuncts in some cases [2].

This case report represents a singular clinical experience, limiting the generalizability of the results. Outcomes may not be universally applicable, necessitating larger, controlled studies to validate the efficacy of the presented management strategies.

Conclusion

Our case report adds to the knowledge on the management of corneal melting after KPro surgery. Sectoral corneal patch graft, an extraocular procedure, might avoid KPro replacement, which is an intraocular surgery with serious potential complications. Successful corneal patch graft surgery, extended tarsorrhaphies, and bandage contact lens application improved the epithelial defect and offered potential visual recovery. Thus, patching melting areas and optimizing the ocular surface should be considered early to avoid more aggressive interventions.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.

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