Eyelid Procedures in Patients Who Have Undergone Boston Keratoprosthesis Surgery

Meredith S. Baker, M.D., Mark Krakauer, M.D., M.Phil.†, Shivani Gupta, M.D., M.P.H.†, Jose de la Cruz, M.D., M.S.†, Maria S. Cortina, M.D.†, Anna S. Kitzmann, M.D.*, Kenneth M. Goins, M.D.*, Richard C. Allen, M.D., Ph.D.*‡, and Pete Setabutr, M.D.†*

**Department of Ophthalmology and Visual Sciences, University of Iowa, Iowa City, Iowa; †Department of Ophthalmology, University of Illinois at Chicago, Chicago, Illinois; and ‡Department of Otolaryngology—Head and Neck Surgery, University of Iowa, Iowa City, Iowa, U.S.A.*

Purpose: Artificial corneas or keratoprostheses such as the Boston keratoprosthesis (KPro) are being used more frequently to provide a clear corneal window in patients with severe corneal disease. A significant percentage of patients who undergo Boston KPro implantation require subsequent eyelid surgery. However, few articles in peer-reviewed literature evaluate the indication and outcome of eyelid procedures after Boston KPro implantation. This study examines the frequency, nature, and outcomes of oculoplastic procedures in patients with Boston KPro implantation.

Methods: A retrospective chart review was conducted of all KPro-1 procedures performed at the University of Illinois at Chicago between December 2006 and September 2010 and all KPro-1 and KPro-2 procedures performed at the University of Iowa between December 2008 and October 2010.

Results: One hundred and twenty eyes underwent Boston KPro-1 procedures, and 2 eyes underwent Boston KPro-2 procedures. Twenty-one (17.2%) of the 122 eyes required subsequent eyelid alterations. Chemical burn was the most common preoperative corneal diagnosis (8 of 21; 38.1%). A variety of oculoplastic procedures were performed; the most common procedure was a permanent lateral tarsorrhaphy. Seventeen (81.0%) of 21 KPro eyes that underwent oculoplastic procedures maintained the KPro at an average of 12.4 months of follow up.

Conclusions: A significant number of patients with Boston KPros require subsequent eyelid surgery. With limited existing literature and increasing popularity for using Boston KPros to treat severe corneal disease, it is essential for oculoplastic and corneal surgeons to understand the need for eyelid alterations in these patients and the surgical intricacies surrounding these cases.

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Artificial corneas or keratoprostheses are being used more frequently to provide a clear corneal window in patients with severe corneal disease (Eye Bank Association of America 2010 statistical report). Many of these patients have a history of chemical injury or ocular inflammation that affects the cornea and the eyelids and adnexal structures. The Boston keratoprosthesis (Boston KPro) represents 1 of the most commonly used keratoprostheses today.[1] Interestingly, a significant percentage of patients who undergo implantation of the Boston KPro require subsequent eyelid surgery; however, literature addressing the issues surrounding the Boston KPro and eyelid procedures is limited. Both type 1 and type 2 Boston KPros are being used in patients to overcome corneal blindness. Eyelid procedures are part of the standard operative procedure in patients undergoing Boston KPro type 2 (KPro-2) procedures (Fig. 1). With this procedure, the eyelids are fused, and a blepharotomy is created. The blepharotomy serves as an opening through which the anterior cylinder of the device penetrates, providing a clear window. The KPro-2 is used for patients with particularly severe ocular surface disease where there are no fornices to support the device.[2] With the mounting support for using these devices to treat severe corneal disease, it is crucial that oculoplastic surgeons be aware of the need for eyelid alterations in these patients. This study examines the frequency, nature, and outcomes of oculoplastic procedures in patients who have undergone Boston KPro implantation.

METHODS

A retrospective chart review was conducted of all KPro-1 procedures performed at the University of Illinois at Chicago Medical Center between December 21, 2006 and September 23, 2010 and of all KPro-1 and KPro-2 procedures performed at the University of Iowa between December 4, 2008 and October 21, 2010 with a minimum follow up of 12 weeks after KPro implantation. Data including demographic information, indication for oculoplastic evaluation, type of oculoplastic procedures performed prior to KPro implantation, type of oculoplastic procedures performed following KPro implantation, complications secondary to oculoplastic procedures, preoperative corneal diagnosis, ability to retain the bandage contact lens, and the presence of exposure keratopathy were collected and analyzed. The study protocol was approved by the institutional review boards at both the University of Illinois at Chicago and the University of Iowa.

RESULTS

A total of 122 eyes underwent Boston keratoprosthesis procedures during the study period. One hundred and twenty eyes underwent Boston KPro-1 procedures, and 2 eyes underwent Boston KPro-2 procedures. Of these 122 eyes, 27 eyes (22.1%) were referred to the oculoplastic service for periocular issues affecting KPro viability and/or optimal functioning; 21 eyes (17.2%) went on to have oculoplastic procedures.

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Address correspondence and reprint requests to Dr. Richard C. Allen, M.D., Ph.D., Department of Ophthalmology and Visual Sciences, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA 52242. E-mail: Richard-Allen@uiowa.edu
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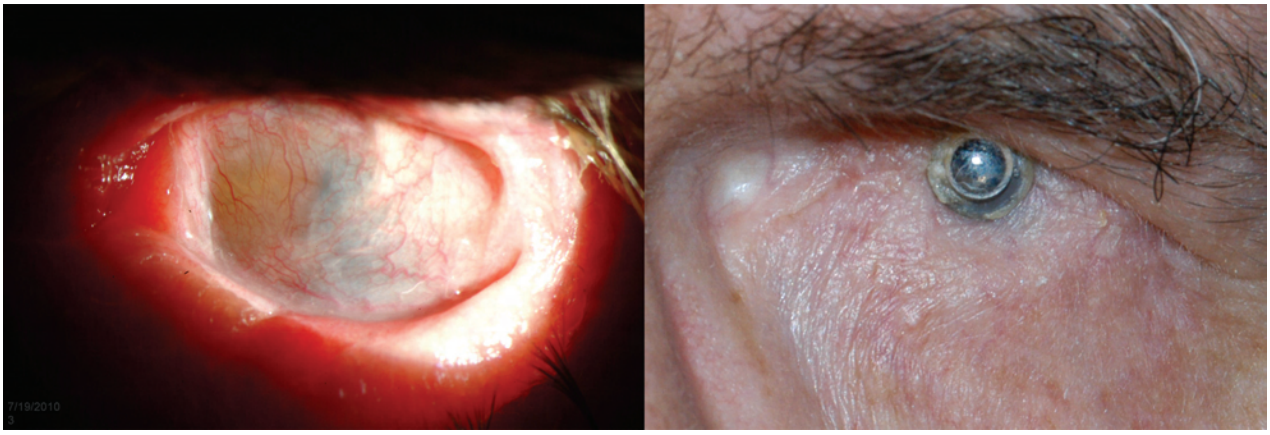

FIG. 1. Preoperative photograph (**left**) and postoperative photograph (**right**) of a patient with Stevens Johnson Syndrome who underwent Boston keratoprosthesis type 2 implantation. There is retraction of the skin away from the optic, which places this patient at risk for device extrusion. For long-term device retention, a buccal mucosal graft over the optic followed by creation of an optical opening 2 to 3 months later is recommended.

Of these 21 eyes that had oculoplastic procedures performed related to the KPro, 15 were male, and 6 were female. The average age was 59 years (range 25–84 years). The mean follow-up time from the initial oculoplastic procedure was 12.4 months (range 3.4–43.5 months). The most common preoperative corneal diagnoses are reviewed in Table 1. Thirteen eyes had had at least 1 prior failed penetrating keratoplasty.

Patients who had undergone Boston KPro-1 procedures were classified as having ocular surface disease, eyelid abnormalities, or both. Patients who had undergone Boston KPro-2 procedures were excluded from this subset analysis as eyelid procedures are a standard part of the KPro-2 procedure regardless of whether the patient has ocular surface disease, eyelid abnormalities, or both. In addition, because patients who undergo Boston KPro-2 procedures do not have fornices to support a contact lens and also require KPro procedures to overcome corneal blindness, these patients most likely have both eyelid abnormalities and ocular surface disease. Ocular surface disease included those patients with exposure keratopathy, poor contact lens retention (and thus, at increased risk for exposure keratopathy), or symblepharon. A bandage contact lens is placed in all KPro-1 eyes following KPro implantation to maintain a hydrated ocular surface, and therefore, prevent corneal melt and subsequent infection. Eyelid abnormalities included those patients with eyelid laxity, retraction, ptosis, ectropion, or entropion. Nine (47.4%) of the 19 eyes that underwent oculoplastic procedures following KPro-1 implantation had both ocular surface disease and eyelid abnormalities, 7 (36.8%) had ocular surface disease, and 3 (15.8%) had eyelid abnormalities.

In total, 28 oculoplastic procedures were performed (Table 2). Permanent lateral tarsorrhaphies were the most common procedure and were performed to reduce exposure keratopathy both by improving contact lens retention and by decreasing exposed ocular surface area (Fig. 2). In some cases of poor contact lens retention, a lateral tarsal strip (n = 2) was performed to improve eyelid apposition to the globe and to decrease eyelid laxity. Müller's muscle-conjunctival resection (n = 1) and levator advancements (n = 2), one in combination with a blepharoplasty, were performed to address ptosis. Upper eyelid retraction was surgically repaired with Müller's muscle excision with levator recession (n = 1). Entropion repair (n = 2) was accomplished with lower eyelid retractor recession with dermis fat graft (n = 1) and with tarsal eyelid fracture (n = 1). Most patients (approximately 70%) undergoing eyelid procedures following KPro procedures had also undergone oculoplastic procedures prior to KPro implantation. Eighty-three percent of the KPro-1 eyes that required a tarsorrhaphy prior to the KPro-1 procedure also required a tarsorrhaphy following the KPro-1. Seven patients (including the 2 KPro-2 eyes) had concurrent oculoplastic procedures at the time of KPro implantation. The 2 KPro-2 eyes had fusion of the eyelids and blepharotomies with the remaining 5 patients all undergoing lateral tarsorrhaphies.

Sixteen eyes (76.2%) had exposure keratopathy on initial oculoplastic evaluation. Following eyelid surgery, 6 (37.5%) still had some exposure issues, and 8 (50%) had no exposure issues at last follow up. One had a failed KPro-2 replaced with a KPro-1, and 1 extruded the KPro-1 without an attempt at reimplantation. Eight (38.1%) patients had difficulty retaining the bandage contact lens on initial oculoplastic evaluation, and 3 of the 8 continued to have problems retaining the contact lens following eyelid surgery at last follow up. Overlap existed between eyes with residual exposure keratopathy and eyes that were unable to retain the bandage contact lens.

There were no complications related directly to the oculoplastic procedures. Six of the KPro-1 eyes (31.6%) and both of the KPro-2 eyes

TABLE 1. Preoperative corneal diagnosis in patients who underwent eyelid surgery

Chemical burn	7 (33.3%)
Infection	4 (19.0%)
Ocular cicatricial pemphigoid	2 (9.5%)
Bullous keratopathy	2 (9.5%)
Trauma	2 (9.5%)
Stevens Johnson syndrome	1 (4.8%)
Thermal burn	1 (4.8%)
Irradiation	1 (4.8%)
Chronic atopic keratoconjunctivitis	1 (4.8%)

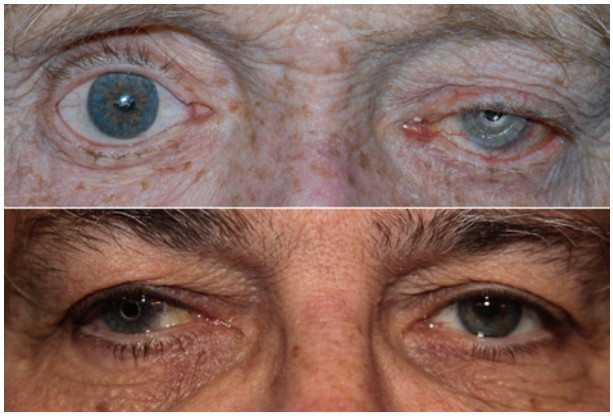

FIG. 2. Photographs of 2 patients who underwent Boston keratoprosthesis type 1 implantation and a lateral tarsorrhaphy.

TABLE 2. Frequency of specific oculoplastic procedure performed

Permanent lateral tarsorrhaphies (including KPro-2 eyes)	15
Ptosis repairs	3
Entropion repairs	2
Lateral tarsal strips	2
Ectropion repairs	2
Blepharotomies (only KPro-2 eyes)	2
1 Müller's muscle excision and levator recession	1
1 repeat botulinum toxin injection	1

(100%) required more than 1 oculoplastic procedure to achieve optimal surgical results. Both KPro-2 eyes underwent revision of the blepharotomies. With an average of 12.8 months follow up, 17 (81.0%) of 21 KPro eyes that underwent oculoplastic procedures maintained the initial KPro. Four eyes extruded their KPro with 2 having a successful reimplantation. KPro reimplantation was not attempted in the other 2 eyes.

DISCUSSION

Boston KPros are being used more frequently to provide clear corneal windows in patients with severe corneal disease, and a significant percentage of eyes undergoing these procedures require subsequent eyelid procedures. However, there is limited data focusing on the periocular issues affecting KPro viability. Research thus far has advocated that maintaining a hydrated ocular surface is crucial to preventing corneal decompensation.[3–5] Data also herald the importance of retaining the bandage contact lens that is used postoperatively to prevent infection.[2,5,6] Ultimately, maintaining a hydrated surface and retaining the bandage contact lens both require proper eyelid function. Many patients undergoing Boston KPro implantation have diseases and injuries such as chemical injury, infection, cicatricial pemphigoid, Stevens Johnson syndrome, and others that not only negatively impact their corneal health but also the health of periocular tissues and adnexal structures.

We report a high percentage of oculoplastic procedures (22.1%) in patients undergoing KPro implantation. The most common preoperative corneal diagnosis was chemical burn (7 of 21; 33.3%). The most common indication for oculoplastic intervention was exposure keratopathy (16 of 21; 76.2%) with most of these patients (9 of 16; 56.3%) also having eyelid abnormalities threatening KPro viability. Previous eyelid surgery appears to predict the need for subsequent eyelid surgery. Despite the complexity of addressing the periocular issues in KPro patients, these patients tolerate oculoplastic and eyelid procedures well, and there were no complications related directly to the oculoplastic procedures. Only 4 eyes extruded their KPro with 2 having successful reimplantation. KPro reimplantation was not attempted in the other 2 eyes.

The main limitations of this study were sample size and retrospective methodology. Although somewhat small, the sample size is comparable to that of other KPro studies.[1–6]

Ultimately, a significant number of KPro patients are requiring eyelid alterations to maintain the viability of their KPro. A multidisciplinary approach to these patients is often necessary for optimal surgical outcome. Therefore, it is important for oculoplastic surgeons to be knowledgeable about KPro implantation, to recognize that ocular surface disease and eyelid abnormalities frequently threaten KPro stability, to be aware of the surgical intricacies surrounding these complex patients, and to realize that eyelid procedures are well tolerated in patients who have undergone previous KPro implantation.

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