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A New Pre-Descemet's Keratoprosthesis

Eleftherios I. Paschalis, Roberto Pineda II, Miguel Gonzalez-Andrades, Andrea Cruzat, Claes H. Dohlman

flex-KPro

Worldwide, there are millions of patients with corneal blindness who are not amenable to standard penetrating keratoplasty. For them, the only viable option is the implantation of an artificial cornea, such as the Boston KPro. However, corneal penetration to implant the device can lead to intraocular complications, such as endophthalmitis and glaucoma, as well as subsequent permanent vision loss. A less invasive keratoprosthesis that does not penetrate the eye, but has the advantages of the modern titanium Boston KPro, may be a safe alternative, as has been proposed previously.

The Boston Keratoprosthesis Laboratory has developed a novel keratoprosthesis, called flex-KPro, that is suitable for non-penetrating implantation. The device uses deep anterior lamellar keratoplasty (DALK) and is designed for implantation over the Descemet's membrane. The flex-KPro is fabricated using a medical grade titanium alloy that allows the back plate to be superelastic and as thin as 40μm. A new optical stem and titanium sleeve support the new design and locking mechanism.

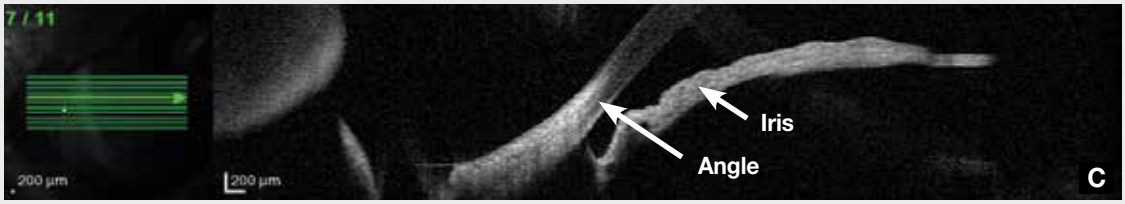
The device was evaluated in rabbits, and preliminary results are very promising. Ten months after flex-KPro implantation, the device remained well tolerated with minimal corneal inflammation and neovascularization (Figures A, B). The anterior chamber anatomy appeared undisturbed (Figure C), and the intraocular pressure remained normal. Further evaluation is currently underway in preparation for human clinical trials.

Flex-KPro in a Rabbit Eye

A: 1 week post-op

B: 10 months post-op

Flex-KPro was implanted in New Zealand white rabbits (n=3) using deep anterior lamellar keratoplasty (DALK). An allograft donor cornea was used as a tissue carrier. Post-operative photo at **a)** 1 week and **b)** 10 months. The flex-KPro was well tolerated and caused minimal corneal inflammation and neovascularization. **c)** At 10 months, the intraocular pressure was normal (<18mmHg) and similar to baseline, while the anterior chamber architecture was maintained. All eyes developed some degree of retro-prosthetic membrane, which was loosely attached to the posterior surface of the KPro stem. Successful removal was performed through the clear cornea using a 30G needle.



A Boston Keratoprosthesis update from
Harvard Ophthalmology / Massachusetts Eye and Ear

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Massachusetts Eye and Ear

Boston KPro *news*

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Toward Practical, Inexpensive, and Safe Implantation of the Boston KPro

Miguel Gonzalez-Andrades, Claes H. Dohlman

Here, the Boston KPro has been preassembled in a fresh corneal donor graft, placed in a vial with 5% Dextran, and gamma irradiated

Presently, the Boston KPro is assembled into a corneal graft by the surgeon in the operating room. The combination is then sutured into the patient's eye. This has led to occasional errors, and the logistics are cumbersome and expensive. To address these issues, the Boston Keratoprosthesis Laboratory is working to simplify this process

Preassembly of the device in a donor cornea, followed by gamma irradiation (an approved method for corneal grafts), would permit long-term storage and direct implantation without the need for assembly into a fresh corneal graft. However, for such a procedure to be approved, it has to be shown that gamma irradiation will not damage the Boston KPro.

Sterilization with Gamma Irradiation

We evaluated the effect of gamma irradiation in the same medical-grade PMMA that is used in the manufacturing of the Boston KPro. Fifteen-millimeter discs of PMMA were submitted to either ethylene oxide sterilization (currently used) or different doses of gamma radiation (10, 25, and 50 kGy). Biocompatibility, mechanical strength, and optical quality of the material were evaluated. Moreover, the feasibility of assembling the device in an allograft, followed by gamma irradiation for sterility, was also evaluated.

No differences in corneal epithelial cell biocompatibility were observed among the samples ($p>0.05$). Mechanical evaluation by nanoindentation showed no alteration in the PMMA after irradiation. Optical evaluation showed similarly high levels of transparency for the ethylene oxide, 10 kGy, and 25 kGy groups. The absorbance of ultraviolet light was higher for the 25 kGy and 50 kGy groups. Technically, preassembly followed by irradiation was uncomplicated.

In summary, sterilization with gamma irradiation had no detectable influence on biocompatibility, mechanical, or optical properties of the device. Preassembly of the device in a donor cornea, followed by sterilization with gamma irradiation —which would allow for long-term storage and ease of implantation—may prove to be an efficient and safe way to provide KPro devices. FDA approval will be necessary before implantation, and is our next goal toward a practical, inexpensive, and safe KPro.

Drug Delivery System for Biologics

Eleftherios I. Paschalis, Chengxin Zhou, Marie-Claude Robert, Demetrios Vavvas, James Chodosh, Claes H. Dohlman

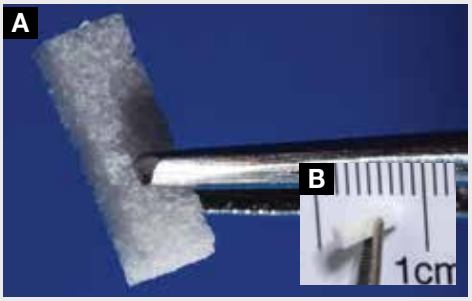
Biologic agents that target cytokines and growth factors are being applied to an expanding spectrum of human systemic and ocular disorders. However, one of the major limitations in the systemic administration of biologic therapies is the risk of systemic adverse events and rapid clearance from the body. Also, the topical application of biologics is hindered by the large molecular size and hydrophilicity of antibodies that limit penetration and bioavailability.

The Boston Keratoprosthesis Laboratory has developed a novel polymer-based drug delivery system (DDS) for sustained delivery of biologic agents to the eye (Figures A-C). The DDS provided sustained, zero-order delivery of anti-TNF-α antibodies *in vitro* and *in vivo* for one and three months, respectively. The antibodies were stable in the DDS for one year when sterilized with gamma irradiation and stored at room temperature.

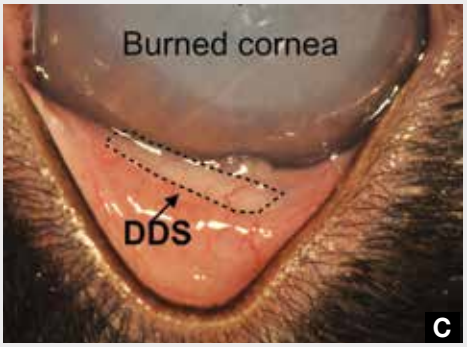
Studies in rabbits demonstrated the safety and efficacy for the treatment of ocular alkali burns using anti-TNF-α (Figure C). Most importantly, subconjunctival anti-TNF-α DDS in rabbit eyes achieved antibody penetration into the posterior segment and subsequent reduction of retinal inflammation, leading to marked neuroprotection following ocular burns. This is particularly important in light of the new findings that corneal alkali burns can cause irreversible retinal damage via inflammation, and that inhibition of TNF-α is protective.

Preliminary results using anti-VEGF DDS in rabbit corneal alkali burns showed marked improvement in corneal wound healing and re-epithelialization. The described drug delivery system opens new possibilities for the treatment of ocular diseases amenable to biologic therapy using FDA-approved drugs.

Drug Delivery Cystem (DDS)



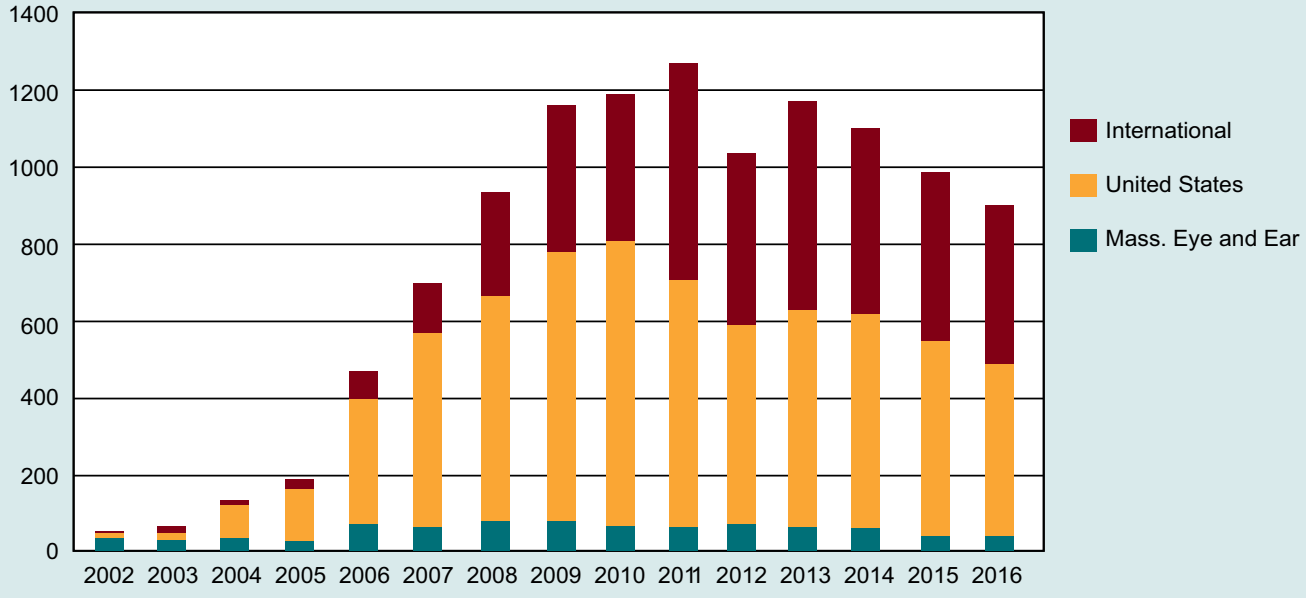
a) *The antibody is loaded into the 3D porous network of the DDS using PVA carrier at desired concentrations.* **b)** *The drug delivery system can be trimmed and shaped as required.*



c) *DDS implanted sub-conjunctivally in a rabbit eye after corneal burn*

Boston KPro Usage

(Approximately 13,000 implanted to date)



Decellularized Porcine Corneas as Human Corneal Substitutes for the Boston KPro

Mohammad Islam, Miguel González-Andrades

Decellularized porcine cornea after applying sterilization and crosslinking.

According to the World Health Organization, 285 million people throughout the world are visually impaired, and among them, 39 million are blind in at least one eye. One of the most common etiologies of blindness throughout the world is corneal disease. Ulceration and trauma cause 1.5–2 million new cases of cornea-related monocular blindness every year. The most widely accepted treatment for corneal blindness is the transplantation of a full-thickness, healthy donor cornea after removing the damaged tissue.

Unfortunately, the availability of donor tissue is substantially less than the demand for transplantation and has resulted in 10 million untreated patients worldwide, with an additional 1.5 million new cases every year. Moreover, other aspects, such as donor tissue quality and donor-derived infection, still challenge the success of transplantation in some areas. For instance, testing a donor tissue for transplantation can elevate the cost of corneal donor tissue to $3,000 or more. For countries with limited resources, a suitable alternative to donor corneas is needed. Although natural and synthetic biomaterial-based artificial cornea development is progressing, the manufacturing of clinical-grade biomaterials is a high-cost process that requires GMP facilities and may be unaffordable for many developing nations.

Xenograft transplantation is considered an alternative to human donor corneas. For example, porcine corneas exhibit similarities to human corneas, including refractive power, size, and mechanical properties. Xenografts have been tested since the 1800s. In 1838, Richard Sharp Kissam transplanted a cornea from a six-month-old pig into the cornea of a young Irishman with a central corneal leucoma. During the same year, a sheep xenograft cornea was placed into a human patient. In most cases, the xenograft transplants failed due to a host immune reaction against the graft. In addition, cross-species diseases are a potentially major complication of xenograft transplantation. These complications might be avoided if the cellular component of the xenograft were removed, while preserving the extracellular matrix. Decellularization can be achieved by different methodologies, according to the species and the type of tissue or organ.

Decellularized corneas have been studied to evaluate their potential as corneal substitutes in the same or cross-species. Several research groups have described different protocols for decellularizing corneal xenografts, evaluating the obtained graft *in vitro* and in animal models. In 2015, decellularized porcine corneas were transplanted into patients for clinical evaluation in China. In this context, sterilization processes, such as gamma irradiation, might be applied to the decellularized xenograft to avoid graft-associated infections. Moreover, gamma irradiation also reduces the antigenicity of the tissue. Gamma-irradiated human corneas are already in use in place of fresh donor corneas for lamellar patch grafts and as carriers for the Boston KPro.

We are working to optimize the decellularization and gamma sterilization of porcine corneas to determine its potential as a carrier for the Boston KPro. Our results demonstrate the efficiency of the technique to optimally decellularize and sterilize the porcine cornea. (See photo.) Moreover, human corneal epithelial cells and keratocytes can grow and migrate into the decellularized xenografts. In the future, decellularized porcine corneas might provide a less expensive and more available substitute for human donor corneas in Boston KPro implantation.

KPro Egypt Mission

Roberto Pineda II

Corneal blindness remains a major health problem globally, as many countries lack eye banks and the necessary resources. Likewise, most patients with corneal blindness live in underdeveloped countries. One such country is Egypt. Although the nation is advancing rapidly, it still has a wide economic gap, and many patients travel far distances for medical care.

During a recent program in Cairo, Egypt, the Boston KPro Type I was employed to help restore vision in two patients with corneal blindness that was not amenable to traditional keratoplasty.

Dr. Roberto Pineda II (left) and Dr. M. Anis (right) with Mohamed after keratoprosthesis surgery

Click-on Aphakic Boston KPro Type I

The first patient was a 19-year-old man with aniridia who had a previous failed penetrating keratoplasty and Morcher large diameter aniridic intraocular lens (IOL) in the right eye. Vision prior to surgery was hand motion.

A click-on aphakic Boston KPro Type I was implanted after removal of the IOL and anterior vitrectomy.

On postoperative day one, his vision was 20/100, and the patient was very happy and giggling at his improved vision. He said it was better than his other eye.

Dr. Roberto Pineda II with Amina after her keratoprosthesis

Boston KPro Type I, Lucia Model

The second patient was a 75-year-old woman with a diagnosis of ocular cicatricial pemphigoid (OCP) who had a failed corneal graft in the right eye and scarring and vascularization in the left eye. Vision was hand motion in both eyes. There was mild fornix foreshortening and tarsal fibrosis in the left eye, but the surface was wet with a strong blink reflex. The patient's OCP was well controlled on immunosuppressants.

The patient underwent implantation of the Boston KPro Type I, Lucia model with removal of her IOL. (See photo on left.) No vitrectomy was necessary.

When the eyepatch was removed the next day, the patient began crying and exclaimed, "I can see!" Her vision was 20/60 with clear media and a healthy optic nerve. Her daughter posted the results on Facebook, and within hours, received more than 1,000 likes.

These cases highlight the impact and work of the KPro team at Massachusetts Eye and Ear. In several international studies, the device has been shown to be effective, providing similar results to those in the United States. Careful patient selection and attentive postoperative management are necessary to achieve successful long-term results.

Profiles of Distinguished Boston KPro Surgeons

These distinguished surgeons were selected based on their exceptional contributions to Boston KPro research, demonstrated excellence in clinical practice, and commitment to teaching the future leaders in the field.

Anthony J. Aldave, MD

Dr. Anthony J. Aldave holds the Walton Li Chair in Cornea and Uveitis and is Chief of the Cornea and Uveitis Division and Director of the Cornea and Refractive Surgery Fellowship Program at the University of California, Los Angeles, Jules Stein Institute.

Dr. Aldave has received numerous honors during his career, including the Alpha Omega Alpha Scholarship Award for graduating first in his medical school class; the Heed Ophthalmic Foundation Fellowship; the American Ophthalmological Society-Knapp Testimonial Fund Fellowship; the first Claes Dohlman Society Award; and the Achievement, Secretariat, and Senior Achievement Awards from the American Academy of Ophthalmology.

Recognized as a leader in the field of KPro surgery, Dr. Aldave has performed more than 200 Boston KPro procedures in the United States. In addition, he has led Boston KPro surgery skills transfer courses in more than a dozen countries, and many of the surgeons that he trained have become the leading KPro surgeons in their countries.

Dr. Aldave is frequently invited to lecture at international ophthalmology meetings on the Boston KPro and has published 19 peer-reviewed articles on the subject. In addition, he is a member of the Boston Type 1 Keratoprosthesis Study Group and is a site principal investigator for the Vision Restoration with a Collagen Crosslinked Boston Keratoprosthesis Unit multicenter study.

M. Soledad Cortina, MD

Dr. Cortina is Associate Professor of Ophthalmology and attending physician in the Cornea Service at the Illinois Eye and Ear Infirmary, Department of Ophthalmology and Visual Sciences. She serves as Director of the Keratoprosthesis Artificial Cornea Program and Director of the Infirmary's Comprehensive Ophthalmology Faculty Practice and General Eye Clinic.

Dr. Cortina joined the Illinois Eye and Ear Infirmary at the University of Illinois at Chicago (UIC) as a board-certified cornea specialist in 2010. She earned her medical degree from the University of Buenos Aires School of Medicine, Argentina. She completed her residency at Louisiana State University (LSU) School of Medicine, followed by a research fellowship at LSU's Neuroscience Center and a clinical fellowship in cornea at UIC's Illinois Eye and Ear Infirmary.

Dr. Cortina specializes in all forms of corneal transplantation and external eye diseases, with a special interest in KPro. Dr. Cortina's research focuses on the regeneration of corneal nerves after corneal and refractive surgery. She also conducts multiple clinical investigations on KPro. Dr. Cortina is Co-editor of *Keratoprostheses and Artificial Corneas: Fundamentals and Surgical Applications*—the first comprehensive textbook dedicated solely to KPro surgery and the artificial cornea.

Recognized internationally for her research in corneal surgery and the KPro, Dr. Cortina has presented at meetings and symposia around the world and has numerous publications in peer-reviewed journals. With a strong commitment to training the future generation of KPro surgeons, she serves as instructor in several KPro courses throughout the year and created an international Kpro fellowship at UIC.

David C. Ritterband MD, FACS

Dr. David C. Ritterband MD, FACS, is a Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai. He is currently the System Director of Refractive Surgery for the Mount Sinai Health System, as well as Assistant Director of the Cornea Service at the New York Eye and Ear Infirmary of Mount Sinai.

Dr. Ritterband earned his undergraduate degree from Duke University and his Doctorate in Medicine from New York Medical College, where he was elected into the Alpha Omega Alpha Medical Honor Society. He served a transitional year internship at St. Vincent's Medical Center in New York and completed his ophthalmology residency at New York Medical College, where he was elected Chief Resident. He completed his Corneal and External Disease fellowship at The Eye and Ear Institute of the University of Pittsburgh School of Medicine.

A nationally recognized clinician scientist, Dr. Ritterband dedicates his time to clinical ophthalmic care, surgery, research, and teaching. He has published more than 65 peer-reviewed manuscripts, several book chapters, and more than 150 research abstracts. He is a frequent lecturer on cornea and refractive surgery topics—both locally and nationally.

His clinical interests span ocular infections, corneal transplantation (including artificial corneal transplantation with Kpro), cataract surgery, and laser refractive surgery.

A committed teacher and mentor, he has trained more than 32 clinical cornea fellows in the highly regarded AUPO-certified corneal fellowship program at the New York Eye and Ear Infirmary of Mount Sinai. As a mentor, Dr. Ritterband is committed to teaching future generations the Boston KPro technique.

Dr. Ritterband has received numerous awards, including an honor award from the American Academy of Ophthalmology, and has been named to *New York Magazine's* Best Doctors, Castle Connolly's Top Doctors, and the *New York Times Magazine's* Super Doctors. He has also received six resident teaching awards from the New York Eye and Ear Infirmary in the past 18 years.

Mark Wilkins, MD

Dr. Mark Wilkins has been a consultant at Moorfields Eye Hospital, where he has been head of the Corneal Service since 2005.

His interests include lamellar graft surgery and the Boston KPro. He has been using the Boston Kpro Type I since 2011, when he established a specialist service at Moorfields to treat patients with the device. Initially, the surgery was funded on a patient-by-patient basis, but now the UK government has set aside funding for KPro surgery.

Today, Moorfields has a specialized KPro clinic that is run in conjunction with the Glaucoma Service (Dr. Nicholas Strouthidis) and Vitreoretinal Service (Dr. Louisa Wickham) to provide more streamlined care. Dr. Wilkins has performed more than 50 KPro procedures to date. The clinic sees patients from throughout the United Kingdom, frequently sharing care with local corneal specialists.

He has two publications in the KPro field:

1. Petrou P, Banerjee PJ, Wilkins MR, et al. Characteristics and vitreoretinal management of retinal detachment in eyes with Boston keratoprosthesis. *British Journal of Ophthalmology*. 2017;101:629-633.
2. Ang, Man, Fenwick, Lamoureux, Wilkins. Impact of type I Boston keratoprosthesis implantation on vision-related quality of life. Accepted for publication in the *British Journal of Ophthalmology* 2017.

THE BOSTON KPRO TEAM

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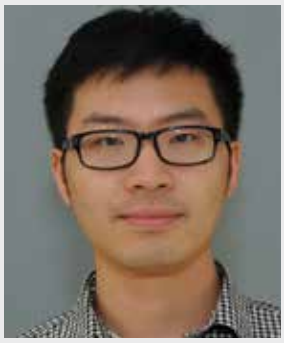

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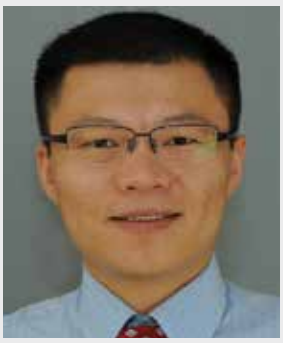

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Boston Keratoprosthesis Bibliography

July 2015 and onward

Retinal detachments after Boston Keratoprosthesis: incidence, predisposing factors, and visual outcomes. Jardeleza MS, Rheaume MA, Chodosh J, Lane AM, Dohlman CH. *Digit J Ophthalmol*. 2015 Dec 21;21(4):1-15.

The Boston Keratoprosthesis type 1 as primary penetrating corneal procedure. Fadous R, Levallois-Gignac S, Vaillancourt L, Robert MC, Harissi-Dagher M. *Br J Ophthalmol*. 2015 Dec;99(12): 1664-8.

Fungal infections after Boston type 1 keratoprosthesis implantation: Literature review and *in vitro* antifungal activity of hypochlorous acid. Odorcic S, Haas W, Gilmore MS, Dohlman CH. *Cornea*. 2015 Dec;34(12):1599-605.

Periprosthetic tissue loss in patients with idiopathic vitreous inflammation after the Boston keratoprosthesis. Grassi CM, Cruzat A, Taniguchi EV, Crnej A, Colby KA, Dohlman CH, Chodosh J. *Cornea*. 2015 Nov;34(11):1378-82.

Contact lens use in patients with Boston keratoprosthesis type 1: Fitting, management, and complications. Thomas M, Shorter E, Joslin CE, McMahon TJ, Cortina MS. *Eye Contact Lens*. 2015 Nov;41(6):334-40.

Endophthalmitis in Boston keratoprosthesis: Case series and review of literature. Chhablani J, Panchal B, Das T, Pathegay A, Motukupally SR, Pappuru RR, Basu S, Sangwan V. *Int Ophthalmol*. 2015 Oct;35(5):673-8.

2016

Boston-keratoprosthesis for idiopathic limbal stem cell deficiency. Mohamed A, Shah R, Sangwan VS. Ocul Immunol *Inflamm*. 2016 Dec 12:1-4.

Sequential versus concomitant surgery of glaucoma drainage implant and Boston keratoprosthesis type 1. Patel V, Moster MR, Kishfy L, Barkan J, Zhan T, Raber IM, Ayres BD, Pro MJ, Waisbourd M. *Eur J Ophthalmol*. 2016 Nov 4;26(6):556-563.

Boston type I keratoprosthesis implantation following autologous submandibular gland transplantation for end stage ocular surface disorders. Gu J, Zhai J, Liao G, Chen J. *Ocul Immunol Inflamm*. 2016 Oct 11:1-4.

Outcomes after auro keratoprosthesis implantation: A low-cost design based on the Boston keratoprosthesis. Venugopal A, Rathi H, Rengappa R, Ravindran M, Raman R. *Cornea*. 2016 Oct;35(10):1285-8.

Streptococcus agalactiae endophthalmitis in Boston keratoprosthesis in a patient with Steven-Johnson syndrome. Al-Otaibi HM, Talea M, Kirat O, Stone DU, May WN, Kozak I. *Middle East Afr J Ophthalmol*. 2016 Oct-Dec;23 (4):329-331.

Innovative approaches to glaucoma management of Boston keratoprosthesis type 1. Vajaranant TS, Liu J, Wilensky J, Cortina MS, Aref AA. *Curr Ophthalmol Rep*. 2016 Sep;4(3):147-153.

[Intraoperative optical coherence tomography in corneal and glaucoma surgical procedures]. Siebelmann S, Bachmann B, Lappas A, Dietlein T, Hermann M, Roters S, Cursiefen C, Steven P. *Ophthalmologe*. 2016 Aug;113(8):646-50.

Tear Matrix Metalloproteinases and myeloperoxidase levels in patients with Boston keratoprosthesis type I. Robert MC, Arafat SN, Spurr-Michaud S, Chodosh J, Dohlman CH, Gipson IK *Cornea*. 2016 Jul;35(7):1008-14.

Infections after keratoprosthesis. Davies E, Chodosh J. *Curr Opin Ophthalmol*. 2016 Jul;27(4):373-7.

Re: Lee et al.: Boston keratoprosthesis: outcomes and complications: a report by the American Academy of Ophthalmology (Ophthalmology 2015;122:1504-11). Kaufman AR, Colby KA. *Ophthalmology*. 2016 Jul;123(7):e42.

Boston keratoprosthesis type 1 in chemical burns. Salvador-Culla B, Kolovou PE, Arzeno L, Martínez S, López MA. *Cornea*. 2016 Jun;35(6):911-6.

[Boston-keratoprosthesis: Preliminary experiences in 13 high-risk eyes from the Department of Ophthalmology of the University of Cologne]. Schaub F, Hos D, Bucher F, Siebelmann S, Bachmann BO, Cursiefen C. *Ophthalmologe*. 2016 Jun;113(6):492-9.

Boston type 1 keratoprosthesis for gelatinous drop-like corneal dystrophy. Lekhanont K, Jongkhajornpong P, Chuephanich P, Inatomi T, Kinoshita S. *Optom Vis Sci*. 2016 Jun;93(6):640-6.

Ultra-widefield imaging of posterior segment pathology in the setting of the Boston keratoprothesis. Kornberg DL, Yannuzzi NA, Klufas MA, D'Amico DJ, Orlin A, Kiss S. *Retina*. 2016 Jun;36(6):1101-10.

Keratoprosthesis: A review of recent advances in the field. J Funct Biomater. Salvador-Culla B, Kolovou PE. 2016 May 19;7(2). pii: E13.

Boston keratoprosthesis outcomes in severe ocular chemical burns in southern China: A retrospective study. Gu J, Zhai J, Zhou S, Chen *J. Adv Ther*. 2016 May;33(5):760-73.

Histological features of cytomegalovirus-related corneal graft infections, its associated features and clinical significance. Chan AS, Mehta JS, Al Jajeh I, Iqbal J, Anshu A, Tan DT. *Br J Ophthalmol*. 2016 May;100(5):601-6.

Corneal reinnervation and sensation recovery in patients with herpes zoster ophthalmicus: An *in vivo* and *ex vivo* study of corneal nerves. Cruzat A, Hamrah P, Cavalcanti BM, Zheng L, Colby K, Pavan-Langston D. *Cornea*. 2016 May;35(5):619-25.

Titanium coating of the Boston keratoprosthesis. Transl Vis Sci Technol. Salvador-Culla B, Jeong KJ, Kolovou PE, Chiang HH, Chodosh J, Dohlman CH, Kohane DS. *Transl Vis Sci Technol*. 2016 Apr 28;5(2):17.

Boston keratoprosthesis for the treatment of corneal blindness: Clinical effectiveness and cost-effectiveness [Internet]. *Ottawa (ON): Canadian Agency for Drugs and Technologies in Health*; 2016 Apr 22.

Protective effect of soft contact lenses after Boston keratoprosthesis. Kammerdiener LL, Speiser JL, Aquavella JV, Harissi-Dagher M, Dohlman CH, Chodosh J, Ciolino JB. *Br J Ophthalmol*. 2016 Apr;100(4):549-52.

Type 1 Boston keratoprosthesis: outcomes at two Canadian centres. Noel CW, Isenberg J, Goldich Y, Conlon R, Teichman J, Rubinger DA, Weinberg TA, Slomovic J, Chan CC, Rootman DS, Baig KM, Slomovic AR. *Can J Ophthalmol*. 2016 Apr;51(2):76-82.

Boston Keratoprosthesis Bibliography

The role of titanium surface microtopography on adhesion, proliferation, transformation, and matrix deposition of corneal cells. Zhou C, Lei F, Chodosh J, Paschalis EI. *Invest Ophthalmol Vis Sci*. 2016 Apr 1;57(4):1927-38.

Evaluation of a low-cost design keratoprosthesis in end-stage corneal disease: a preliminary study. Sharma N, Falera R, Arora T, Agarwal T, Bandivadekar P, Vajpayee RB. *Br J Ophthalmol*. 2016 Mar;100(3):323-7.

Glaucoma management after corneal transplantation surgeries. Kornmann HL, Gedde SJ. *Curr Opin Ophthalmol*. 2016 Mar;27(2):132-9.

Subconjunctival bevacizumab for the treatment of keratoprosthesis-associated cystoid macular edema. Muakkassa NW, Klein KA, Hamrah P, Reichel E. Ophthalmic Surg Lasers Imaging *Retina*. 2016 Mar;47(3):276-9.

Vitreoretinal complications in eyes with Boston keratoprosthesis Type 1. Rishi P, Rishi E, Koundanya VV, Mathur G, Iyer G, Srinivasan B. *Retina*. 2016 Mar;36(3):603-10.

Boston Type 1 Keratoprosthesis Study Group. Visual acuity outcomes of the Boston keratoprosthesis type 1: Multicenter Study Results. Rudnisky CJ, Belin MW, Guo R, Ciolino JB. *Am J Ophthalmol*. 2016 Feb;162:89-98.e1.

Keratoprosthesis in pediatric keratitis-icthyosiform-deafness syndrome. Brown C, Rowlands M, Lee D, Geffin JA, Huang J. J *AAPOS*. 2016 Feb;20(1):73-5.

Errata: Advantages of microscope-integrated intraoperative online optical coherence tomography: usage in Boston keratoprosthesis type I surgery. Siebelmann S, Steven P, Hos D, Hüttmann G, Lankenau E, Bachmann B, Cursiefena C. *J Biomed Opt*. 2016 Feb;21(2):29801.

Advantages of microscope-integrated intraoperative online optical coherence tomography: usage in Boston keratoprosthesis type I surgery. Siebelmann S, Steven P, Hos D, Hüttmann G, Lankenau E, Bachmann B, Cursiefen C. *J Biomed Opt*. 2016 Jan;21(1):16005.

Delayed Boston keratoprosthesis exchange due to a preceding vitreoretinal surgery with intraoperative choroidal detachment. Relimpio López MI, Gessa Sorroche M, Garrido Hermosilla AM, Laborda Guirao T, Espejo Arjona F, Rodríguez de la Rúa Franch E. *Ophthalmologica*. 2016;235(1):61.

Fungal infections in Boston keratoprosthesis patients: Lessons learned and novel developments on the horizon. Odorcic S, Sabeti S, Haas W, Durand ML, Dohlman CH. *Semin Ophthalmol*. 2016;31(1-2):71-84.

2017

Vision retention in early versus delayed glaucoma surgical intervention in patients with Boston keratoprosthesis type 1. Lin M, Bhatt A, Haider A, Kim G, Farid M, Schmutz M, Mosaed S. *PLoS One*. 2017 Aug 4;12(8).

The Boston keratoprosthesis. Saeed HN, Shanbhag S, Chodosh J. *Curr Opin Ophthalmol*. 2017 Jul;28(4):390-396.

No light perception outcomes following Boston Keratoprosthesis type 1 surgery. Muzychuk AK, Durr GM, Shine JJ, Robert MC, Harissi-Dagher M. *Am J Ophthalmol*. 2017 Jun 26. S0002-9394(17)30257-X.

Measuring forward light scatter by the Boston keratoprosthesis in various configurations. Abdelaziz M, Dohlman CH, Sayegh RR. *Cornea*. 2017 Jun;36(6):732-735.

[Mid-and Long-term experiences with the Boston-keratoprosthesis. The Cologne and Salzburg Perspective]. Schaub F, Bachmann BO, Seyeddain O, Moussa S, Reitsamer HA, Cursiefen C. *Klin Monbl Augenheilkd*. 2017 Jun;234(6) 770-775.

Infliximab after Boston keratoprosthesis in Stevens-Johnson syndrome: An update. Robert MC, Crnej A, Shen LQ, Papaliodis GN, Dana R, Foster CS, Chodosh J, Dohlman CH. *Ocul Immunol Inflamm*. 2017 Jun;25(3):413-417.

Impact of total pars plana vitrectomy on postoperative complications in aphakic, snap-on, type 1 Boston keratoprosthesis. Perez VL, Leung EH, Berrocal AM, Albini TA, Parel JM, Amescua G, Alfonso EC, Ali TK, Gibbons A. *Ophthalmology*. 2017 May 17. pii: S0161-6420(16)30760-6.

Characteristics and vitreoretinal management of retinal detachment in eyes with Boston keratoprosthesis. Petrou P, Banerjee PJ, Wilkins MR, Singh M, Eastlake K, Limb GA, Charteris DG. *Br J Ophthalmol*. 2017 May;101(5):629-633.

Boston keratoprosthesis type I in the elderly. Homayounfar G, Grassi CM, Al-Moujahed A, Colby KA, Dohlman CH, Chodosh J. *Br J Ophthalmol*. 2017 Apr;101(4):514-518.

Corneal surgery in the flying eye hospital: characteristics and visual outcome. Hussain Farooqui J, Sharifi E, Gomaa A. *Can J Ophthalmol*. 2017 Apr;52(2):161-165.

Endoscopic cyclophotocoagulation for the treatment of glaucoma in Boston keratoprosthesis type II patient. Poon LY, Chodosh J, Vavvas DG, Dohlman CH, Chen TC. *J Glaucoma*. 2017 Apr;26(4):e146-e149.

Outcomes of bilateral sequential implantation of the Boston keratoprosthesis type 1. Vaillancourt L, Papanagnu E, Elfekhfakh M, Fadous R, Harissi-Dagher M. *Can J Ophthalmol*. 2017 Feb;52(1):80-84.

Corneal graft dellen in a patient implanted with a Boston keratoprosthesis type 1. Scotto R, Vagge A, Traverso CE. *Int Ophthalmol*. 2017 Feb;37(1):263-266.

Corneal melt after Boston keratoprosthesis: Clinical presentation, management, outcomes and risk factor analysis. Bouhout S, Robert MC, Deli S, Harissi-Dagher M. *Ocul Immunol Inflamm*. 2017 Jan 12:1-7.

The Boston keratoprosthesis: Highs and lows of intraocular pressure and outcomes. Baratz KH, Goins KM. *Ophthalmology*. 2017 Jan;124(1):9-11.

Boston keratoprosthesis type 1: A Randomized controlled trial of fresh versus frozen corneal donor carriers with long-term follow-up. Muzychuk AK, Robert MC, Dao S, Harissi-Dagher M. *Ophthalmology*. 2017 Jan;124(1):20-26.

Long-term visual outcomes and complications of Boston keratoprosthesis type II implantation. Lee R, Khoueir Z, Tsikata E, Chodosh J, Dohlman CH, Chen TC. *Ophthalmology*. 2017 Jan;124(1):27-35

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Massachusetts Eye and Ear

Join us at these upcoming events. . .

XXV Congress of the European Society of Cataract and Refractive Surgeons (ESCRS)

October 7–11, 2017: Lisbon, Portugal

Boston Type 1 Keratoprosthesis: From Indications to Innovations
Saturday, October 7, 5:00–6:00pm
Leader: M. Cortina, MD

Boston KPro Surgical Skills Training Course
Sunday, October 8, 9:30–10:30am and
11:00am-1:00pm

American Academy of Ophthalmology Meeting

November 11–14, 2017: New Orleans

Boston Keratoprosthesis Users Breakfast
Sunday, November 12, 7:00–8:30 am
Marriott at the Convention Center, Meeting Room:
Blaine Kern F

AAO KPro Course:
The Boston Keratoprosthesis: Case-Based Presentations Highlighting the Essentials for Beginning and Experienced Surgeons
Sunday, November 12, 4:30–5:30pm
Senior Instructor: Sadeer B. Hannush, MD

AAO KPro Course:
Surgery for Severe Corneal and Ocular Surface Disease
Director: Ali R. Djalilian, MD
Lab 124A – Sunday, November 12, 3:30–5:30pm
Room: 344-345, Morial Convention Center

October 12-14, 2017 | Boston, MA

The Biennial Cornea Conference is the premier global anterior segment eye research conference. The event brings together basic and clinical researchers in the field of cornea and ocular surface.

HIGHLIGHTS

Thursday evening, October 12

- Poster Session, hosted by Boston University School of Medicine in the Hiebert Lounge

Friday, October 13

- Scientific and clinical presentations related to ocular surface immunology and microbiology; endothelial cell biology; and innovation and new techniques
- J. Wayne Streilein Lecture:
  Reza Dana, MD, MPH, MSc
- Cocktail reception and dinner at the Liberty Hotel

Saturday, October 14

A celebration of Claes H. Dohlman, MD, PhD, and his 60 years of contributions to corneal science and education

- Talks from past Dohlman Fellows
- Claes H. Dohlman Lecture:
  Kazuo Tsubota, MD, PhD

eye.hms.harvard.edu/cornea/conference