

An Improved Temporary Keratoprosthesis

The trunkless design permits an unobstructed view of the posterior segment during surgery to repair ocular trauma.

BY HANNAH PARK, BS; FAISAL FAYYAD, MD; AND MAURICE LANDERS III, MD

In this issue of Retina Today, Hannah Park, BS; Faisal Fayyad, MD; and Maurice Landers III, MD, describe the use of a novel temporary keratoprosthesis in an ocular trauma surgery.

We extend an invitation to readers to submit pearls for publication in Retina Today. Please send submissions for consideration to Dean Elliott, MD (dean_elliott@meei.harvard.edu) or Ingrid U. Scott, MD, MPH (iscott@hmc.psu.edu). We look forward to hearing from you.



— Dean Elliott, MD, and Ingrid U. Scott, MD, MPH

Repair of severe ocular trauma often requires the surgeon to perform intravitreal surgery while attempting to look through a damaged and often opaque cornea. In the distant past, treatment options in this situation were limited to open-sky vitrectomy, corneal graft surgery under suboptimal conditions, or delaying treatment until the cornea was clear enough for sufficient visualization. Thirty years ago, Landers et al reported the successful use of a temporary keratoprosthesis (TKP) in the surgical repair of a traumatized eye.¹ Since then, several improvements have been made in the design and use of TKPs (Figure 1).²⁻⁴

We report a case in which the latest design of a TKP (Landers wide-field trunkless TKP, Ocular Instruments) was used to visualize the vitreous cavity and posterior pole, to aid in the removal of intraocular foreign bodies, and to provide adequate visualization to permit internal limiting membrane (ILM) peeling over the macula with the aid of brilliant blue staining.

This latest TKP has no central trunk extending down into the opening in the cornea (Figure 2). The “seal” between the interior of the eye and the exterior atmosphere is located on the surface of the peripheral cornea (Figure 3). This is made possible by the rigid nature of the PMMA TKP. The advantage provided by the trunkless TKP is the one-size-fits-all corneal openings, with an upper limit of 8.5 mm, which is the distance between the inner margins of opposing suture holes in the trunkless TKP. Thus, it is no longer necessary to have multiple TKPs available to deal with variously sized corneal openings.

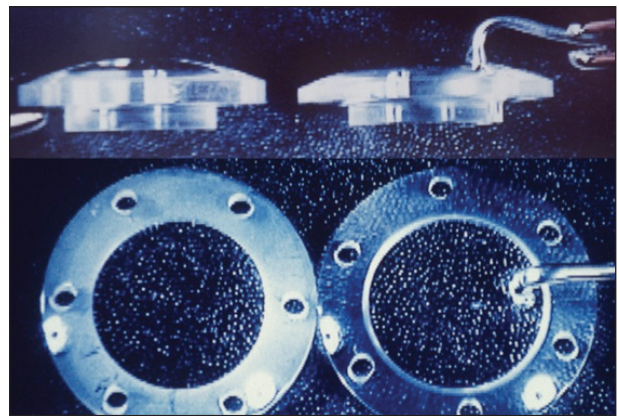


Figure 1. PMMA TKP with trunk (left) and a TKP with infusion (right).

CASE REPORT

A 30-year-old Yemeni soldier was referred for surgical treatment of a traumatic injury to the right eye. His ocular injuries included a scarred cornea and a traumatic cataract with retained small intraocular foreign bodies.

The cornea in the patient's right eye was significantly scarred, such that visualization of the posterior segment was essentially impossible. The decision to use the trunkless TKP was made due to the necessity of surgical repair of an injured posterior segment in the presence of a damaged and scarred cornea.⁵

Corneal trephination was performed to remove the central scarred cornea; the diameter of the trephined

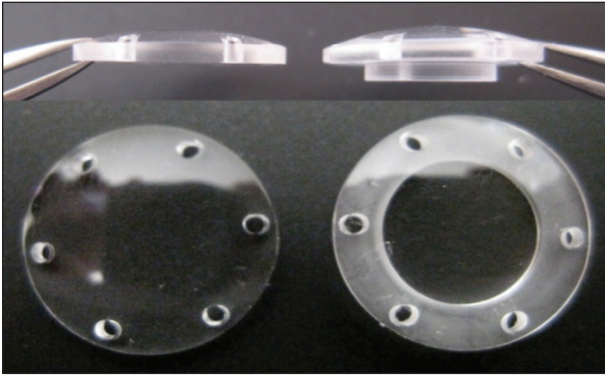


Figure 2. Trunkless TKP (left) and TKP with trunk (right).

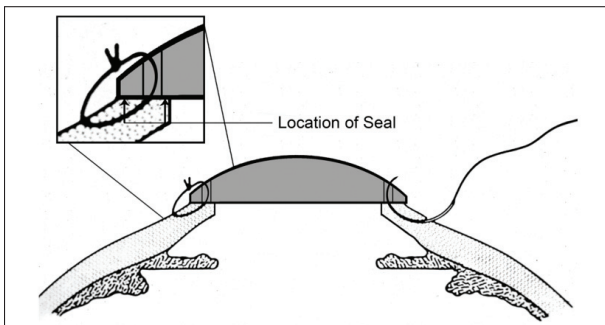


Figure 3. This schematic diagram shows a cross-section of the Landers widefield trunkless TKP sutured into the cornea. Note the location of seal formation between the flat underside of the TKP and the cornea.

corneal button was 7.5 mm. The traumatic cataract was hydrodissected and removed. The TKP was then sutured into place (Figure 4). Three sclerotomies were placed around the periphery of the trunkless TKP to accommodate cannulas for the vitrectomy instruments. Once the trunkless TKP was sutured into place, a clear view into the posterior chamber made it possible to proceed with vitrectomy (Figure 5). A 23-gauge pars plana vitrectomy was performed after a posterior capsulectomy to clear the fundus view. An intravitreal foreign body was freed from within the vitreous; however, it dropped down over the retina. Another foreign body was noted to be located anterior to the retina at the pars plana level. The procedure continued with complete vitreous base shaving.

One of the initial sclerotomy sites was enlarged to allow the use of 20-gauge instruments. The first foreign body that had fallen to the retina was removed using a backflush cannula (Charles cannula). The second foreign body was removed by suction through a 20-gauge vitreous cutter.

After removal of the foreign bodies, brilliant blue dye was injected to assist with visualizing the ILM so that it could be peeled around the center of the macula (Figure 6). At this point, it was possible to place an intra-

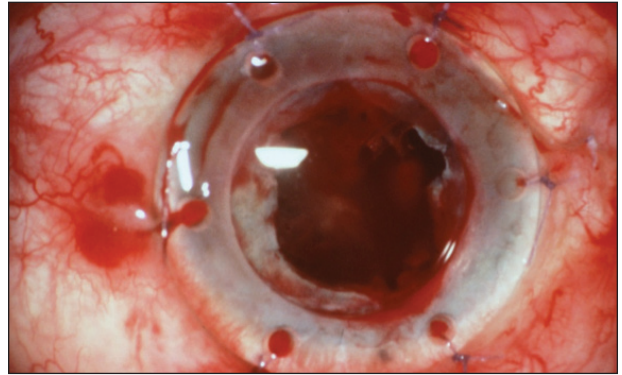


Figure 4. A trunkless TKP sutured into place.

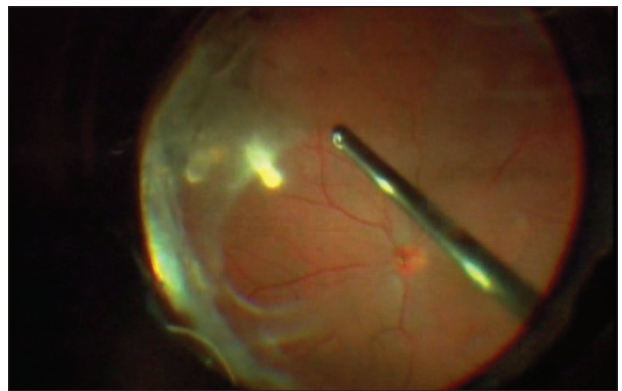


Figure 5. Vitrectomy visualized through a trunkless TKP.

ocular lens implant within the remaining capsular bag. Once the posterior chamber surgical repair had been completed, the trunkless TKP was removed, and a donor cornea of 7.75 mm was sutured into place with interrupted stitches. Air-fluid exchange was performed with the removal of the instruments and cannulas.

DISCUSSION

It is important to note that during the surgery, bimanual maneuvers were performed with significant depression of the sclera. Even with this pressure and firm handling, the trunkless TKP did not leak, except for 1 brief moment when 1 of the suture holes in the trunkless TKP lens was allowed to inadvertently override the central opening into the cornea.

This case demonstrates the usefulness of the newly designed trunkless TKP. It is a durable and reusable device which permits a widefield view of the posterior segment during vitreoretinal surgery that is not limited by the need to accommodate a central trunk. This latest trunkless TKP may be used for several types of corneal trauma cases, including those with large, irregular wounds. The use of this trunkless TKP obviates the need to have multiple TKPs of varying trunk diameters available in the OR.

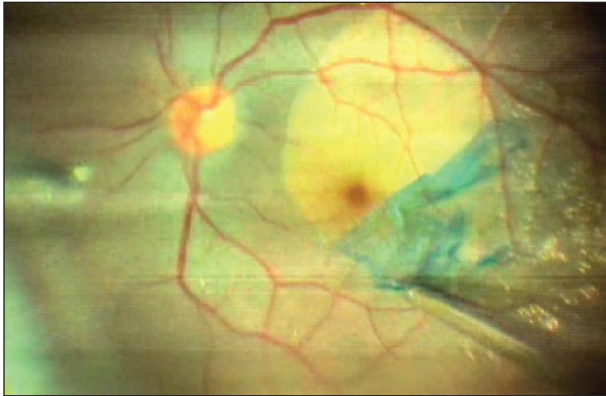


Figure 6. ILM peeling visualized through a trunkless TKP.

CONCLUSION

The development of the TKP has allowed the surgical repair of eyes that have experienced anterior and posterior segment trauma, providing the opportunity to salvage those eyes with injuries requiring penetrating keratoplasty and pars plana vitrectomy. Improvements in TKP design permit the use of strong anchoring sutures, creating fluid- and air-tight seals between the cornea and the widefield TKP. This allows the use of fluid-gas exchange, dissection of the peripheral vitreous, scleral depression, and the use of silicone oil and perfluorocarbon liquids in the initial management of severe trauma cases. Further improvements allowing infusion through the TKP and the development of a trunkless TKP have expanded the role that these devices may play in the management of the most devastating ocular injuries. ■

Hannah Park, BS, is a fourth-year medical student at the University of North Carolina Chapel Hill. She plans to pursue a career in ophthalmology.

Faisal Fayyad, MD, is a senior vitreoretinal surgeon and chairman of the ophthalmology department at Jordan Hospital, Amman, Jordan. Dr. Fayyad may be reached at ffayyadmd@gmail.com.

Maurice B. Landers III, MD, is a professor of ophthalmology at the University of North Carolina Chapel Hill, North Carolina. Dr. Landers may be reached at maurice_landers@med.unc.edu.



1. Landers MB III, Foulks GN, Landers DM, et al. Temporary keratoprosthesis for use during pars plana vitrectomy. *Am J Ophthalmol*. 1981;91(5):615-619.
2. Eckardt C. A new temporary keratoprosthesis for pars plana vitrectomy. *Retina*. 1987;7(1):34-37.
3. Toth CA, Landers MB III. A new wide-field temporary keratoprosthesis. *Retina*. 1993;13(4):353-356.
4. Benner JD, Landers MB III. An infusion temporary keratoprosthesis for pars plana vitrectomy. *Am J Ophthalmol*. 1996;122(4):579-580.
5. Watson J, Tran T, Landers M. The Landers trunkless temporary keratoprosthesis. *Arch Ophthalmol*. 2011;129(8):1067-1069.