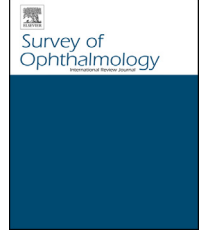




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Major review

Vitreoretinal aspects of permanent keratoprosthesis



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ABSTRACT

Permanent keratoprosthesis (KPro) is a treatment option in patients with severe corneal disease not amenable to traditional penetrating keratoplasty. There are several types of permanent keratoprostheses available for use worldwide, including the Boston KPro, osteo-odonto KPro, and AlphaCor, among others. A multidisciplinary team of cornea, glaucoma, and vitreoretinal specialists is necessary to ensure proper patient selection, preoperative planning, keratoprosthesis placement, postoperative monitoring and management of complications. We provide a comprehensive review of the vitreoretinal aspects of permanent keratoprostheses.

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1. Introduction

Keratoprosthesis (KPro) is the act of replacing a diseased native cornea with an artificial cornea or device.⁵⁶ Pellier de

Quengsy, a French ophthalmologist, first applied the concept in 1789 by placing a piece of glass surrounded by a silver ring in an opaque cornea.⁶⁸ Almost two centuries later, the observation that polymethylmethacrylate embedded in the

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corneas of soldiers who had sustained trauma in World War II was well tolerated served as a starting point for the use of biocompatible materials for keratoprotheses. Over time, advances in device design and postoperative management have led to improved outcomes, expanded indications, and grown utilization of keratoprotheses.⁵⁶

Vitreoretinal considerations are paramount in the preoperative evaluation, including determining the need for combined surgery at the time of initial KPro placement. Postoperative posterior segment complications remain a significant cause of vision loss and KPro failure.⁵⁵ The vitreoretinal specialist plays an important role in evaluation and management of patients with permanent KPro. We review the preoperative, intraoperative, and postoperative vitreoretinal considerations in the setting of permanent keratoprosthesis.

2. Temporary versus permanent keratoprotheses

For complex combined anterior segment and vitreoretinal procedures with an opaque cornea, a temporary KPro^{16,28,54,91} (such as Landers-Foulks or Eckhardt⁵⁷) may be utilized for proper visualization of the posterior segment during the vitrectomy portion of the surgery. These cases typically conclude with either a penetrating keratoplasty or placement of a permanent KPro. We will focus on permanent KPros.

3. Modern-day permanent keratoprotheses

The Cardona KPro and modified versions were among the first successful devices in the modern era of KPros.¹¹ Currently, the three most widely used KPros are the Boston KPro (available in type I,²⁶ type II,⁶⁹ and newer low-cost ‘Lucia modification’, used primarily outside the United States), the osteo-odonto keratoprosthesis (OOKP),³¹ and the AlphaCor.⁴⁴ Other less commonly used devices include the Worst KPro (used primarily in India), the Fyodorov-Zuev KPro,³⁵ and the Moscow Eye Microsurgery Complex in Russia KPro (both used in Russia),^{46,47} and the Legeais and Lacombe KPros in France. Today, approximately a dozen centers around the world are involved in the development of KPros.^{53,37} We will focus on

clinical studies involving the most commonly used KPro worldwide, the Boston KPro, as well as the AlphaCor and OOKP.

4. Vitreoretinal surgery

4.1. Initial keratoprosthesis surgery

Successful KPro surgery begins with proper patient selection.^{24,56} Given the required commitment to frequent physician visits and the life-long use of topical medications, reliable and compliant patients are ideal candidates. A multidisciplinary team approach, including cornea, glaucoma, pediatric, oculoplastics, dental, and vitreoretinal specialists, is necessary to ensure successful initial keratoprosthesis placement.

From a vitreoretinal standpoint, combining vitrectomy with initial keratoprosthesis surgery has multiple benefits, including assessment of the visual potential of the eye (with careful attention to retinal and optic nerve status, Figs. 1 and 2), removal of potentially inflammatory materials, and preparation for concurrent or subsequent glaucoma drainage implant placement.^{55,63} Vitrectomy at the time of initial KPro placement allows for simpler and controlled removal of the crystalline lens, which is at near certain risk for cataract given the extensive steroid therapy required with the device. Lens removal is considerably more complex once a KPro has been placed.⁵⁵ Some centers also prefer to remove an existing intraocular lens at the time of KPro placement, given that the optical power can easily be incorporated into the KPro and any subsequent procedures will be easier in an aphakic eye.

4.2. Vitreoretinal surgical techniques in the setting of a permanent keratoprosthesis

Pars plana vitrectomy is possible through permanent KPro without the use of a temporary KPro.^{42,55,73,74} Vitrectomy with a permanent KPro is safe and has no deleterious effects on the donor cornea/graft KPro device. Cohort studies report the incidence of vitrectomy after KPro placement to be around 7%.⁴² Retrobulbar anesthesia is typically used in the same manner as other vitrectomies. An open sky (Fig. 1) approach is possible, but makes it more difficult to maintain intraocular

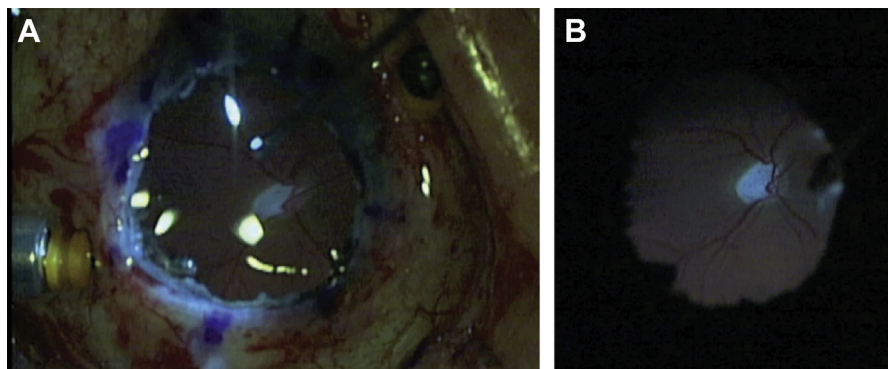


Fig. 1 – Open sky fundus visualization. Open sky view of posterior pole (A). Visualization under the operating microscope is improved with the room lights dimmed and the light pipe placed into the anterior vitreous cavity (B).

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