Corneal blindness is responsible for approximately 10% of blindness cases worldwide. More importantly, in most developing countries, corneal diseases represent the second leading cause of blindness. The history of corneal transplant surgery is an intriguing and fascinating story of more than 200 years duration filled with wild theories, animal experiments (xenograft), human trials, colorful adventurism, and serious clinical science. Early fascination with the idea of restoring clarity to an opacified cornea first emerged in the writings of Galen (130-200 AD), who suggested the concept of restoring the transparency of an opaque cornea. He recommended a form of superficial keratectomy—abrasio corneae.

Erasmus Darwin (1731-1802), the grandfather of Charles Darwin, takes the credit for first mentioning the concept of corneal trephination as part of the procedure to manage leucomatous cornea in 1760. The 19th century was filled with experimentation and frustration. In 1824, Franz Reisinger coined the term keratoplasty and proposed the concept of replacing a scarred cornea with a transparent animal cornea—corneal xenograft. After the initial 30 years of the 19th century, interest in keratoplasty declined, and pioneers then concluded that it was simply an audacious fantasy. In 1906, from the small town of Morava in the Czech Republic came the first report of a successful penetrating keratoplasty by Edward Konrad Zirm. Although this surgical procedure did not signal the onset of unqualified success in the field of corneal transplant surgery, this single case report certainly rekindled the interest among his colleagues to further refine this procedure. A few years later, in 1914, Anton Elschnig developed partial penetrating keratoplasty as a viable surgical option using the von Hippel trephine.

Eye banking was fundamental to the advancement of corneal transplant surgery in the Western Hemisphere. Although keratoplasty in the 1940s was demonstrably successful, the scarcity of donor material was clearly the limiting factor. Richard Townley Paton set up the first eye bank in 1944 in New York City. The maturation and development of keratoplasty as a standard surgical technique of the later part of the 20th century could occur only with the refinements of surgical volume, improved microsurgical instrumentation, and better understanding of corneal physiology.

The inspirational seed for posterior lamellar transplants were originally planted by Jose I. Barraquer. He described a method of endothelial keratoplasty using an anterior approach using laser-assisted in situ keratomileusis flap. After cutting a partial-thickness flap with a microkeratome, the posterior cornea was trephined and replaced with a donor graft that was sutured in place. The flap was then replaced and sutured. The next big advance arrived with little fanfare in 1993. In a poster presented at an Association for Research in Vision and Ophthalmology meeting, Ko et al. reported success with a new scleral-limbal approach in a rabbit model. The surgeons made an incision in the sclera and tunneled deep into the cornea, where they were able to remove the endothelium without touching the corneal surface. The endothelium was then replaced with donor tissue.

In 1998, Dutch surgeon Gerrit R. J. Melles became the first surgeon to perform this scleral-limbal procedure in humans. The Melles procedure, which he named posterior lamellar keratoplasty (PLK), involved a 9 mm scleroconjunctival pocket incision and relied on an intracameral air bubble for the dissection and resection of recipient tissue and for placing and attaching the donor endothelium. This was later refined to small-incision (5 mm) PLK where the donor tissue was folded into half for insertion. During this time, Mark Terry from Portland, Oregon, refined PLK and introduced the use of ophthalmic viscosurgical device for PLK and renamed this procedure as deep lamellar endothelial keratoplasty in 2003. Surgical improvements and the introduction of the microkeratome led to the introduction of Descemet-stripping endothelial keratoplasty and Descemet-stripping automated endothelial keratoplasty with the use of the microkeratome, which automates the donor dissection of the posterior lenticule. Melles further-refined endothelial keratoplasty led to a new surgical procedure termed Descemet membrane endothelial keratoplasty.

Corneal scarring secondary to infectious keratitis remains the leading cause of corneal blindness worldwide. However, in the Western Hemisphere, posterior corneal diseases remain the leading indication for endothelial keratoplasty. In this issue, Dunker et al. (page 865) present
the first report of the European Cornea and Cell Transplant Registry, highlighting the practice patterns of corneal transplantation among 10 European member states, the United Kingdom, and Switzerland. This report mirrors the 2019 statistical report of the Eye Bank Association of America, in that endothelial dystrophy, regrafts, and pseudophakic corneal edema remain the top 3 indications for endothelial keratoplasty on either side of the Atlantic, and Descemet-stripping automated endothelial keratoplasty is the most predominant technique of endothelial keratoplasty.13

As we go through the finer surgical refinements of replacing the diseased corneal endothelium, the future is bright and exciting as research and progress takes place in the potential functional restoration of the diseased corneal endothelial cells.

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