

Restoring Clarity: A Modern Look at Corneal Transplant Success Rates

Emily Martinez*

Department of Ophthalmology, Wuxi Clinical College, Nantong University, Wuxi, China

DESCRIPTION

Corneal transplantation stands among the most successful and frequently performed tissue transplantation procedures worldwide. For decades, it has represented a beacon of hope for patients suffering from corneal blindness due to infections, dystrophies, trauma, or degenerative conditions. The transparent, avascular nature of the cornea has traditionally made it an ideal candidate for transplantation, offering fewer immunological challenges compared to solid organs. Yet, the evolution of surgical techniques, advancements in donor tissue preservation, and improved postoperative management have dramatically reshaped the landscape of graft survival and visual outcomes. Today, corneal transplant success rates vary across procedures from full-thickness Penetrating Keratoplasty (PK) to lamellar surgeries such as endothelial keratoplasty and anterior lamellar keratoplasty. Each technique carries distinct advantages, limitations, and prognostic factors.

This commentary takes a comprehensive look at modern corneal transplant success rates, contextualizing them within current surgical innovations, immunological considerations, and patient-specific variables. As global eye-care systems strive to reduce avoidable blindness, understanding the evolving efficacy of corneal transplants becomes crucial. The goal is not only to examine numerical success rates but also to explore the reasons behind improved outcomes, persistent challenges, and the future directions of corneal transplantation. Modern corneal transplantation has expanded significantly beyond traditional penetrating keratoplasty. Where PK once dominated, selective tissue replacement techniques now allow surgeons to treat only the diseased layers of the cornea. This evolution has directly enhanced graft survival rates, reduced recovery time, and decreased immunological complications.

As the oldest and most established corneal transplant technique, PK involves replacing the entire corneal thickness. Historically, PK success rates were limited by postoperative complications such as graft rejection, astigmatism, and wound dehiscence. Nevertheless, PK still demonstrates high overall survival rates often at five years particularly in indications such as keratoconus. However, its success declines in high-risk eyes with

vascularized or inflamed corneas, where immune rejection remains a leading cause of graft failure.

Techniques such as DSAEK (Descemet Stripping Automated Endothelial Keratoplasty) and DMEK (Descemet Membrane Endothelial Keratoplasty) have revolutionized corneal transplantation for endothelial dysfunction. By replacing only the diseased endothelial layer, surgeons avoid many complications associated with full-thickness transplantation. DMEK, in particular, boasts long-term survival rates exceeding, with minimal rejection and rapid visual rehabilitation. This shift toward layer-specific transplantation marks a defining progression in corneal graft success.

Deep Anterior Lamellar Keratoplasty enables selective replacement of the anterior stromal layers while preserving the recipient's healthy endothelium. Because endothelial rejection is a major threat in PK, retaining the host endothelium significantly reduces immunologic risk. As a result, DALK offers exceptional long-term survival and lower rejection rates, especially for conditions such as keratoconus and anterior dystrophies. These newer techniques have collectively improved overall graft survival. They also broaden the range of patients eligible for transplantation, making corneal surgery safer and more predictable. Even with the cornea's natural immune privilege, rejection remains a critical determinant of transplant success. The immune response varies significantly between surgical techniques. Full-thickness grafts expose the host to donor antigen across all corneal layers, whereas lamellar grafts limit antigen exposure and thereby reduce immunologic reactions. The type of graft influences the immune response dramatically. PK undergoes higher rejection rates due to full-thickness exposure. In contrast, DMEK presents rejection rates below 1%, making it one of the safest ocular grafts from an immunological standpoint. Advances in topical immunosuppressants, particularly calcineurin inhibitors such as tacrolimus, have allowed clinicians to better manage high-risk grafts. Tailoring immunosuppression to individual patient profiles enhances graft longevity and has contributed significantly to improved success rates over recent years.

Modern eye banking practices play a pivotal role in determining corneal transplant success. Standardized donor screening,

Correspondence to: Emily Martinez. Department of Ophthalmology, Wuxi Clinical College, Nantong University, Wuxi, China, E-mail: emilymartinez@la.sr

Received: 04-September-2025, Manuscript No. JCEO-25-39424; **Editor assigned:** 08-September-2025, PreQC No JCEO-25-39424 (PQ); **Reviewed:** 22-September-2025, QC No. JCEO-25-39424; **Revised:** 29-September-2025, Manuscript No. JCEO-25-39424 (R); **Published:** 09-October-2025, DOI: 10.35248/2155-9570.25.16.1034

Citation: Martinez E (2025). Advances in Experimental Ophthalmology: From Bench Research to Clinical Insight. Clin Exp Ophthalmol. 16:1034.

Copyright: © 2025 Martinez E. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

improved storage media (such as Optisol-GS), and pre-cut tissue preparation for lamellar procedures have collectively improved reproducibility and surgical outcomes. For endothelial transplantation, higher endothelial cell density strongly correlates with better long-term graft clarity. Conversely, anterior lamellar grafts are far more forgiving regarding donor parameters. Eye banks now routinely prepare DMEK and DSAEK tissue, reducing intraoperative risk and standardizing tissue quality a major contributor to rising success rates worldwide.

Success rates are not determined solely by surgical skill or donor quality; patient characteristics play a significant role. Conditions like keratoconus generally yield excellent outcomes, particularly with DALK, due to healthier surrounding ocular tissues. Conversely, ocular surface disorders such as Stevens–Johnson syndrome or severe chemical injuries significantly reduce graft survival due to chronic inflammation and limbal stem cell deficiency. Additionally, patient compliance with postoperative care including topical steroids, lubrication, and follow-up visits is a crucial determinant of long-term success. Younger individuals, due to more robust immune reactivity, may be at higher risk of graft rejection, particularly after PK.

Understanding these variables allows surgeons to tailor surgical approaches and counseling to optimize visual results. Recent research consistently demonstrates rising success rates across most corneal transplant techniques. Full-thickness grafts now last longer due to improved surgical precision, better optical correction tools, and advances in postoperative management. Meanwhile, lamellar keratoplasty survival rates continue to surpass those of PK in many indications, with some procedures boasting near-perfect long-term clarity.

Additionally, global improvements in public health systems, expanded access to donor tissue, and wider availability of lamellar procedures have contributed to the rising success rates. Where corneal blindness once represented an irreversible burden, patients worldwide increasingly experience restored vision and improved quality of life.

CONCLUSION

The landscape of corneal transplantation has undergone a profound transformation, driven by advancements in surgical techniques, enhanced donor tissue management, and improved immunological understanding. Today's corneal graft success rates reflect not only scientific progress but also a more refined and individualized approach to patient care. Selective tissue replacement techniques such as DMEK and DALK have revolutionized outcomes, reducing complications and dramatically improving graft longevity. Meanwhile, continued improvements in eye banking, postoperative management, and surgical technology collectively contribute to rising success rates globally.

Yet challenges remain. High-risk grafts, immunological rejection, ocular surface disease, and limited donor availability in some regions still hinder universal success. The future of corneal transplantation will likely blend biological innovation such as endothelial cell therapy and artificial corneas with refined surgical precision. Ultimately, the modern era of corneal transplantation offers more than restored clarity it offers renewed hope, reaffirming the transformative power of ophthalmic science to preserve and restore vision.