Refractive Surgery and the Cornea: LASIK, PRK, and Beyond.

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Introduction

Refractive surgery has transformed the landscape of vision correction, offering alternatives to traditional glasses and contact lenses. Among the various techniques available, LASIK (Laser-Assisted In Situ Keratomileusis) and PRK (Photorefractive Keratectomy) are the most commonly performed procedures. These surgeries target the cornea, reshaping it to correct refractive errors such as myopia (nearsightedness), hyperopia (farsightedness), and astigmatism. This article explores the mechanisms, benefits, and advancements in refractive surgery, focusing on LASIK, PRK, and emerging techniques [1,2].

Refractive surgery aims to correct vision by altering the corneal shape, which affects how light is focused on the retina. The cornea, being the eye's primary refractive surface, plays a crucial role in this process. Both LASIK and PRK involve reshaping the cornea using laser technology, but they differ in their methods and recovery profiles. LASIK involves creating a thin flap in the corneal tissue, lifting it to allow the laser to reshape the underlying corneal stroma. After reshaping, the flap is repositioned, where it adheres naturally without the need for stitches [3,4].

An ophthalmologist uses a microkeratome or femtosecond laser to create a corneal flap. An excimer laser is used to precisely remove corneal tissue based on the patient's refractive error. The corneal flap is repositioned over the treated area. Most patients experience significant vision improvement within 24 to 48 hours. The procedure is relatively painless, with only mild discomfort reported post-operatively. LASIK has a high success rate, with the majority of patients achieving 20/25 vision or better [5].

Temporary dryness is common but usually resolves within a few months. Issues with the flap, such as dislocation or irregular healing, can occur. Some patients may experience glare, halos, or decreased night vision. PRK differs from LASIK in that it does not involve creating a flap. Instead, the outer layer of the cornea (epithelium) is removed to expose the corneal stroma, where the laser reshapes the cornea. The epithelium regenerates naturally over time [6].

The epithelium is removed using a brush or laser. The excimer laser reshapes the cornea. A bandage contact lens is placed to protect the cornea while the epithelium heals. PRK eliminates the risk of flap-related complications associated with LASIK. It is often preferred for patients with corneas too thin for LASIK. There is a reduced risk of dry eye symptoms compared to LASIK [7].

Healing takes longer, with vision improvement typically occurring over several weeks. Patients may experience more discomfort and a longer period of visual blurriness. Recent developments in refractive surgery have led to new techniques and technologies that enhance safety, precision, and outcomes. Femtosecond lasers are used to create corneal flaps in LASIK with greater precision and safety compared to mechanical microkeratomes. Creates more consistent and precise flaps, reducing the risk of complications. Minimizes potential damage to corneal tissue [8].

Wavefront technology maps the eye's unique optical aberrations to guide the laser treatment, leading to improved visual outcomes and reduced aberrations. Provides a personalized approach, addressing individual visual imperfections. Reduces glare and halos, improving night vision quality. Uses corneal topography maps to guide laser treatment, correcting not only refractive errors but also corneal irregularities. Corrects complex visual errors and irregularities. Enhances visual quality and reduces post-operative issues [9].

SMILE is a minimally invasive technique that involves creating a small incision to remove a lenticule of corneal tissue, reshaping the cornea without creating a flap. Reduces the risk of dry eyes and flap complications. Offers rapid visual recovery similar to LASIK. Proper post-operative care is crucial to ensure optimal healing and visual outcomes. Key aspects include: Regular follow-ups with the ophthalmologist to monitor healing and address any complications. Use of prescribed antibiotic and anti-inflammatory eye drops to prevent infection and manage inflammation [10].

Conclusion

Refractive surgery has revolutionized vision correction, offering effective alternatives to glasses and contact lenses. LASIK and PRK remain the cornerstone techniques, each with distinct advantages and considerations. Advances such as femtosecond lasers, wavefront-guided LASIK, and SMILE continue to enhance the precision and safety of these procedures. Understanding these techniques and their advancements allows patients to make informed decisions and achieve the best possible visual outcomes.

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