

Comparing the Benefits of PRK and LASIK

The progression from PRK to femtosecond LASIK reveals surgical advantages along the way.

BY DAMIAN B. LAKE, MB, CHB, FRCOPHTH

There are many benefits associated with both PRK and LASIK. Who could have predicted more than 20 years ago, when the first PRK was performed,¹ that this procedure would produce the innovative multibillion-euro refractive surgical industry that we have today? Both PRK and LASIK have enabled millions of people with myopia or hyperopia to achieve spectacle independence, and both procedures share other characteristics such as low complication rates and predictable outcomes in the treatment of low refractive errors.

FROM PRK TO MICROKERATOME LASIK

One of the most significant benefits of PRK for surgeons is the procedure's technically unchallenging nature, making the intraoperative experience a low-tension event. Because no corneal flap is created, surgeons and patients do not have to worry about flap complications. The patient also benefits because the residual structurally intact corneal stroma is thicker, and induction of an unstable cornea, with resulting progressive myopic astigmatism and other features of ectasia, is a rare event.

If PRK were a perfect procedure, however, there would have been no stimulus for Ioannis G. Pallikaris, MD, and Lucio Buratto, MD, as well as others to climb to the next rung on the ladder of refractive surgery innovation. What provoked these refractive surgeons to look for a better way to correct mild to moderate myopia, hyperopia, and astigmatism? Answers include patient pain, infections caused by prolonged epithelial defects, corneal haze, the limited range of treatable refractive errors, and the length of time needed to reach refractive stability.

The efforts of refractive surgery pioneers to improve PRK outcomes resulted in the development of LASIK. This microkeratome-based procedure enabled highly predictable refractive correction, a wider range of refractive treatment, relatively quick visual rehabilitation, and long-term stability. However, these benefits came with a price: the corneal flap. Although microkeratome LASIK addressed many of the problems associated with PRK, the creation of the flap introduced a new set of possible complications, including

buttonholes, free caps, variable depth cuts, diffuse lamellar keratitis, and increased risk of ectasia due to deeper tissue ablation. Microkeratome technology evolved from the initial models; however, the mechanical microkeratome is no longer as popular as it once was due to the advent of the femtosecond laser as an ophthalmic instrument.

FEMTOSECOND LASIK

Femtosecond laser technology has been used for micromachining in industry for many years. Ultrashort wavelength laser technology produces clean cuts in metals, polymers, explosives, and other substances. The use of femtosecond lasers to create better corneal flaps in LASIK is an example of innovation transfer based on the concept of the *adjacent possible*, a term coined by the scientist Stuart Kauffman. This concept is "the premise that innovation prospers when ideas can serendipitously connect and recombine with other ideas ... a kind of shadow future, hovering on the edges of the present state of things, a map of all the ways in which the present can reinvent itself."²

Flaps created with a femtosecond laser are reproducible with much greater control and predictability than those created with a microkeratome. The shape, depth, edge profile, edge angle, hinge site, and hinge length are programmed preoperatively in the laser room. The surgeon has a clear view as the laser creates the flap, which is in

TAKE-HOME MESSAGE

- PRK is technically unchallenging; however, complications, a limited range of treatable refractive errors, and length of time needed to reach refractive stability prompted the development of microkeratome LASIK.
- Microkeratome LASIK enabled highly predictable refractive correction, a wider range of refractive correction than PRK, quick visual rehabilitation, and long-term stability. However, the corneal flap introduced a new set of complications.
- Flaps created with a femtosecond laser are reproducible with greater control and predictability than a microkeratome.

stark contrast to those few heart-stopping moments that elapse as a microkeratome traverses the cornea. Creating a femtosecond flap feels controlled from start to finish, with few issues to concern the surgeon. The integrity and structural stability of the femtosecond laser flap is apparent to surgeons who have performed retreatments on patients with mechanical microkeratome flaps. These flaps lift easily, even many years later. Comparatively speaking, lifting a flap made with a femtosecond laser is a more delicate art.

FINAL THOUGHTS

From a historical perspective, PRK offered the greatest benefit initially, microkeratome LASIK improved on PRK, and femtosecond LASIK, which improved further on its predecessor, is currently the treatment of choice for most refractive surgeons and their patients. Innovation will continue to create solutions to solve current problems, and these solutions will inevitably produce challenges of their own.

Developments will continue in the area of corneal reshaping. Ultrashort wavelength lasers may be used to remove predictably shaped corneal lenticles for refractive correction, or polymers in novel shapes may be created to add to the cornea for the same purpose. Often, in the natural progression of innovation, small steps are replaced by a great

leap forward that would not otherwise have been predicted. Therefore, perhaps the next rung on refractive surgery's ladder of innovation may not be related to the cornea but may rather involve developments in phakic IOL technology or even reshaping the natural crystalline lens.

PRK served our patients well in the past, and still does for a select few. LASIK, which has occupied a dominant share of the refractive market for the past 10 years, continues in the tradition of PRK by providing patients with the opportunity for spectacle independence. Doctors and patients alike look forward to benefiting from the exciting innovations in refractive surgery that will be the next to emerge on the horizon. ■

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