

LASER VISION CORRECTION ENHANCEMENT METHODS

PREFERENCES AMONG LASIK, PRK, AND SMILE.

BY KENDALL E. DONALDSON, MD, MS; AUDREY R. TALLEY ROSTOV, MD; JOHNNY MOORE, MD; AND RICHARD MCNEELY, BSC, PHD, MCOPTOM



KENDALL E. DONALDSON, MD, MS

How I Choose Among Laser Vision Enhancement Methods for Premium IOLs

There is quite a bit of variability among surgeons when it comes to choosing PRK, LASIK, or SMILE for enhancements after premium IOL surgery. Many of us have developed a bias based on what works best in our own hands with a particular patient subtype. I use either PRK or LASIK for enhancements. I used to do more PRK enhancements a decade ago, but over the past few years, I have been performing more LASIK enhancements to provide a faster, more comfortable recovery for patients who may already feel frustrated.

WHEN I CHOOSE PRK

I prefer PRK for three subsets of patients:

- No. 1: Patients with preexisting dry eye disease;

- No. 2: Patients who have received one or more limbal relaxing incisions, so that I can avoid creating a discontinuous flap in the region of the relaxing incision; and
- No. 3: Patients with mild anterior basement membrane dystrophy, although I should note that many of these patients (especially those with moderate to severe involvement) are not good candidates for premium IOL technologies.

WHEN I CHOOSE LASIK

LASIK has become quicker, easier, and more accurate since the introduction of topography- and wavefront-guided treatments and faster, more precise laser systems that use small spot sizes. LASIK is an excellent way to enhance residual myopic refractive errors after

premium lens surgery. Impatient, frustrated patients who may not tolerate the pace of recovery after PRK are ideal candidates for LASIK.

It should be noted that both LASIK and PRK are limited in their ability to correct hyperopic refractive errors because of their common association with significant degrees of higher-order aberrations (HOAs).^{1,2} For this reason, I am more likely to perform a lens-based procedure (such as an IOL exchange) to address residual hyperopic refractive error, particularly if the residual error is spherical.

WHEN SMILE WOULD BE INDICATED

Although I do not use SMILE to enhance results after placement of a premium lens, it is a reasonable option, particularly for surgeons who perform SMILE routinely. Recovery after SMILE may be a little slower than after LASIK, but it is generally faster than after PRK. SMILE is also limited to the correction of myopia with or without astigmatism and not approved for the treatment of hyperopia.

“THERE IS QUITE A BIT OF VARIABILITY AMONG SURGEONS WHEN IT COMES TO CHOOSING PRK, LASIK, OR SMILE FOR ENHANCEMENTS AFTER PREMIUM IOL SURGERY. MANY OF US HAVE DEVELOPED A BIAS BASED ON WHAT WORKS BEST IN OUR OWN HANDS WITH A PARTICULAR PATIENT SUBTYPE.”

1. Plaza-Puche AB, El Aswad A, Arba-Mosquera S, et al. Optical profile following high hyperopia correction with a 500-hz excimer laser system. *J Refract Surg.* 2016;32(1):6-13.

2. Motwani M. Topographic-guided treatment of hyperopic corrections with a combination of higher order aberration removal with WaveLight Contoura and wavefront-optimized hyperopic treatment. *Clin Ophthalmol.* 2018;12:1021-1029.



AUDREY R. TALLEY ROSTOV, MD

A Preference for PRK on Premium IOL Patients Who Require Enhancements

After the implantation of a premium IOL, whether it be a toric, extended depth of focus, or multifocal, I evaluate patients for residual astigmatism and residual refractive error. Either can have a significant impact on quality of vision.

MY PREFERENCE: PRK

I perform PRK on most of my premium IOL patients who require an enhancement. The reasons for my preference include that the procedure is quick and easy to perform and that it produces excellent results in these patients. I find that I can nail any residual refractive error, especially residual astigmatism. Another plus is that I can simultaneously correct very

mild surface abnormalities, if present, with PRK.

In my experience, many patients who want enhancements after receiving premium IOLs have a history of refractive surgery, usually LASIK. Because most of them had the procedure many years ago, lifting the flap can be challenging. For this reason, I tend to perform PRK on these patients, even if it's on top of the previous LASIK flap.

The amount of residual refractive error is generally small after placement of a premium IOL. If the error is significant, the conversation changes to a discussion of options such as IOL exchange and toric IOL rotation.

WHEN I MIGHT USE LASIK

One scenario in which I would perform a LASIK enhancement is for a younger patient who developed a cataract after receiving a Visian ICL (STAAR Surgical). I would perform the LASIK enhancement after ICL removal and cataract surgery.

SMILE

I have not done, and wouldn't necessarily recommend, SMILE as an enhancement procedure for anyone with a premium IOL. I don't think that the amount of residual refractive error is sufficient to necessitate SMILE. Additionally, a lot of these patients have mixed astigmatism or a little bit of hyperopia, which is better addressed by PRK.



JOHNNY MOORE, MD; AND RICHARD MCNEELY, BSC, PHD, MCOPTOM

Laser Vision Enhancement of Premium IOLs: A European Perspective

Prior to laser vision correction to enhance the result achieved with a premium IOL, we take a detailed ocular history and conduct a full ophthalmologic investigation, which includes a clinical examination, corneal topography, and both anterior and posterior OCT imaging. This information can influence our management of each patient.

Initially, we consider whether it is appropriate to perform an enhancement based on the patient's symptoms. Patients should not be treated on the basis of residual refractive error alone. If they are symptomatic, we allow them additional time—often 2 to 3 months—for neural adaptation and refractive stability. If we then deem treatment to be appropriate based on the patient's reported quality

of vision, several factors require careful consideration.

PREOPERATIVE CONSIDERATIONS

Refractive error. Myopic eyes can be treated with PRK, LASIK, or SMILE. For a patient with a healthy eye who requires earlier intervention, I (JM) would perform either a PRK or LASIK enhancement. Residual hyperopia or hyperopic astigmatism require treatment with either LASIK or PRK. In these cases, I generally prefer LASIK due to the speed of recovery but will perform PRK if other corneal issues are detected.

Because of the procedure's many advantages, SMILE would be my choice for a healthy eye with residual myopic error of greater than 0.75 D if there were no time constraints. Advantages include a reduced effect on the

corneal nerves and the subsequent preservation of the tear film,¹ which is often mildly compromised in older patients; additional biomechanical advantages; safety because of no flap creation; and speed of recovery.^{2,3} I would allow 6 months to elapse after the initial IOL implantation to avoid disturbing the cataract incisions.

Tear film and ocular surface. Whichever enhancement procedure is selected, a careful examination of the tear film and ocular surface is required. If a reduced tear film is observed, aggressive management of the ocular surface is necessary to optimize the chances of uneventful recovery after laser treatment. Management may include antiinflammatories, antibiotics, physical lid massage, and intense pulsed light.⁴ If no significant improvement

occurs, the best option may be not to perform an enhancement at all. SMILE is particularly advantageous in older patients following IOL surgery, as a reduced tear film is more common in this patient population. I try to avoid PRK in older patients (> 70 years) with a substandard tear film because of its effect on the tear film; I have heard of anecdotal cases of poor healing and scarring.

Corneal topography. This diagnostic test is essential in deciding on which laser enhancement procedure to perform. Patients may have a history of laser vision correction, trauma, or corneal infection. SMILE is not appropriate for those with corneal problems or significant HOAs, but both PRK and LASIK are options.

I would select PRK for patients with epithelial basement membrane dystrophy or other irregularity to the epithelium or epithelial basement membrane. In patients with recurrent erosion syndrome or epithelial basement membrane dystrophy, alcohol debridement can be performed to remove the irregular epithelium, followed by PRK. I find that a transepithelial approach using the Amaris excimer laser (Schwind, not available in the United States) facilitates the use of epithelial masking to improve PRK results in eyes with stromal irregularities such as corneal scars. In the presence of corneal abnormalities as outlined above, I would not use multifocal IOLs, but would still use premium monofocal IOLs—both toric and nontoric.

Topography-guided LASIK or PRK can correct HOAs caused by previous refractive surgery.

DECIDING WHAT LVC PROCEDURE IS BEST

When PRK is best. PRK is effective for the treatment of residual refractive error,^{5,6} but it is best reserved for patients who have an associated corneal issue such as epithelial irregularity; epithelial basement membrane

irregularity; or anterior stromal irregularity, including HOAs induced by previous corneal refractive surgery. I would use transepithelial PRK for eyes with corneal stromal irregularities. PRK is also appropriate for patients with normal corneas and a healthy tear film if early corrective surgery is required, and it can be used in a transepithelial mode even for low levels of refractive error by increasing the optical zone.

When LASIK is best. LASIK is well known to be safe and effective for the treatment of myopia, hyperopia, and astigmatism after cataract surgery.^{7,8} One key advantage of this procedure is the painless and rapid recovery, and it is for this reason that I perform LASIK to enhance outcomes in premium IOL patients with any residual refractive error who have a healthy tear film and require rapid surgical recovery. LASIK can be performed in patients who have a mildly reduced tear film following optimization and thorough patient counseling. We generally wait at least 4 months after IOL surgery to perform a LASIK enhancement.

When SMILE is best. SMILE surgery has clear advantages in protecting the ocular surface. If a patient can wait the required 6 months for an enhancement, I would perform SMILE to correct residual myopia if the refractive error is greater than 0.75 D. For lower levels of refractive error, I would use one of the other laser modalities. A period of ocular surface optimization may be required if the tear film is reduced.

WHEN TO AVOID LASER VISION CORRECTION

If a patient does not respond to tear film management, I generally do not pursue a refractive surgery enhancement so as not to exacerbate dry eye disease. It is very important to counsel patients properly in these circumstances and to discuss other options, such as IOL exchange. (Editor's note: For more on the topic of IOL exchange, see "IOL Exchange or Piggyback," by Asim R. Piracha,

MD; and David A. Goldman, MD, on page 41.)

For any patient potentially undertaking further laser vision correction following premium IOL surgery, preoperative counseling is essential to ensure that he or she understand the potential side effects, which include dry eye and continued dysphotopsias from multifocal IOLs. ■

1. Denoyer A, Landman E, Trinh L, et al. Dry eye disease after refractive surgery: comparative outcomes of small incision lenticule extraction versus LASIK. *Ophthalmology*. 2015;122(4):669-676.
2. Wang B, Zhang Z, Naidu RK, et al. Comparison of the change in posterior corneal elevation and corneal biomechanical parameters after small incision lenticule extraction and femtosecond laser-assisted LASIK for high myopia correction. *Cont Lens Anterior Eye*. 2016;39(3):191-196.
3. Yu M, Chen M, Dai J. Comparison of the posterior corneal elevation and biomechanics after SMILE and LASEK for myopia: a short- and long-term observation. *Graefes Arch Clin Exp Ophthalmol*. 2019;257(3):601-606.
4. Albiets JM, Schmid KL. Intense pulsed light treatment and meibomian gland expression for moderate to advanced meibomian gland dysfunction. *Clin Exp Optom*. 2018;101(1):23-33.
5. Fan YY, Sun CC, Chen HC, Ma DH. Photorefractive keratectomy for correcting residual refractive error following cataract surgery with premium intraocular lens implantation. *Taiwan J Ophthalmol*. 2018;8(3):149.
6. Sáles CS, Manche EE. Managing residual refractive error after cataract surgery. *J Cataract Refract Surg*. 2015;41(6):1289-1299.
7. Kim P, Briganti EM, Sutton GL, et al. Laser in situ keratomileusis for refractive error after cataract surgery. *J Cataract Refract Surg*. 2005;31:979-986.
8. Kuo IC, O'Brien TP, Broman AT, et al. Excimer laser surgery for correction of ametropia after cataract surgery. *J Cataract Refract Surg*. 2005;31:2104-2110.

KENDALL E. DONALDSON, MD, MS

- Professor of Clinical Ophthalmology, Cornea/ External Disease/Refractive Surgeon, and Medical Director, Bascom Palmer Eye Institute, Plantation, Florida
- Member, *CRST* Editorial Advisory Board
- kdonaldson@med.miami.edu
- Financial disclosure: None

RICHARD MCNEELY, BSC, PHD, MCOPTOM

- Optometrist, Cathedral Eye Clinic, Belfast, Ireland
- richard.mcneely@cathedraleye.com
- Financial disclosure: None

JOHNNY MOORE, MD, PHD

- Director, Cathedral Eye Clinic, Belfast, Northern Ireland
- Visiting Professor, University of Ulster, School of Biomedical Sciences, United Kingdom
- Visiting Professor, Tianjin Medical University Eye Hospital, Tianjin, China
- johnny@cathedraleye.com
- Financial disclosure: Consultant (Carl Zeiss Meditec)

AUDREY R. TALLEY ROSTOV, MD

- Private practice, Northwest Eye Surgeons, Seattle
- Medical advisory board, SightLife, Seattle
- atalleyrostov@nweyes.com
- Financial disclosure: None acknowledged