

# CLINICAL GUIDELINES: IDENTIFYING LASIK CANDIDATES



**LASIK is the most widely known refractive procedure but not always the best choice.**

**BY ALAN R. FAULKNER, MD; AND NEDA NIKPOOR, MD**

Since the FDA's approval of an excimer laser in 1995 for PRK, corneal laser procedures have been the workhorse of refractive surgery. In the late '90s, concerns over pain, recovery time, and subepithelial haze associated with PRK fueled a shift toward LASIK, and FDA approval came in 1999. LASIK quickly moved into the forefront with faster recovery times, less associated pain, and improved outcomes.

LASIK initially introduced a number of variables, as mechanical microkeratomers produced flaps with relatively large standard deviations in thickness and diameter. The appearance of post-LASIK ectasia introduced concerns regarding appropriate guidelines for safe treatment.

Fortunately, because LASIK has remained the main refractive procedure since its introduction, a large amount of data has been generated and analyzed.

Additionally, technology to image and analyze the cornea is continually being upgraded, and improvements in microkeratomers and the development of femtosecond lasers for flap creation have reduced surgical variability.

Despite these developments, controversy remains regarding the limits of LASIK and the most appropriate technologies to determine corneal safety. In this article, we outline the guidelines we use at our practice

# LASIK FLAP FOR SMILE RECOVERY



BY HERCULES D. LOGOTHETIS, MD

in Hawaii to identify appropriate candidates for LASIK.

## PATIENT WORKUP

Every patient we see for a refractive surgery screening has a thorough workup consisting of a discussion about hobbies, lifestyle, and visual goals. We obtain patients' medical and eye history and perform diagnostic testing and an undilated eye exam. We inquire about refractive stability, especially for younger patients.

We consider it essential to review anterior and posterior corneal topography. We examine the Belin/Ambrósio Enhanced Ectasia Display on the Pentacam (Oculus Optikgeräte). We perform corneal aberrometry and LipiScan dynamic meibomian imaging (Johnson & Johnson Vision) on every patient, and we use the HD Analyzer (Visiometrics) in patients older than 45 years. For suspicious corneas or corneal scars, we obtain epithelial thickness mapping or anterior segment OCT.

Although each element in this array of diagnostic imaging devices may not be essential in every patient, we find that each one provides valuable information for certain patients and in certain diagnostic dilemmas.

## RANGE OF TREATMENT

Depending on the platform, current FDA approvals for LASIK allow treatment of myopia up to -12.00 D, astigmatism up to 6.00 D, and hyperopia up to 6.00 D. Our experience is based primarily on wavefront-optimized treatments. Depending on the applied treatment pattern (ie, the laser platform), treatment at the extremes of those ranges may induce more aberrations, more dry eye disease (DED), and more dysphotopsias.

In our opinion, a comfortable range of myopia correction with LASIK is up to -8.00 D. Above that, we tend to favor lens-based procedures—a phakic IOL such as the Visian ICL (STAAR Surgical) in young patients or refractive lens exchange (RLE) for patients in the presbyopia age range. Although we

have treated myopia as great as -12.00 D with LASIK, these treatments are less predictable and have a higher incidence of side effects.

Many surgeons advocate performing PRK in patients with thin corneas outside the range for LASIK, but this should be done cautiously, especially in sunny areas (like Hawaii) with a higher risk of postoperative haze. Therefore, we tend to favor the ICL over PRK for high corrections in eyes with thin or abnormal corneas. Several studies, including a contralateral eye study conducted years ago, showed that, with myopia greater than -6.00 or -8.00 D, patients preferred ICL over LASIK.<sup>1,2</sup> ICL implantation was also found to be more stable than LVC for patients with high and extreme myopia, which is

In addition to the clinical guidelines for LASIK outlined by Drs. Faulkner and Nikpoor, the

flap portion of the procedure can be helpful in other situations, such as the one I describe here.

A 35-year-old woman elected to undergo SMILE for the correction of myopic astigmatism. During the femtosecond portion in her left eye, she began to squeeze her eyes, and a suction break occurred with about 3 seconds to go. I tried for about 10 minutes to redock the eye; however, she could not see the light and was not following directions very well. In hindsight, I should have cleared the opaque bubble layer with an instrument. I eventually replaced the suction, hoping it was central enough, but this second attempt at a proper cap was off-center and the lenticule edge was outside the cap. I completed the dissection in her right eye and waited until the next day to address the left after discussion with peers.

The next day, I used a 120- $\mu$ m LASIK flap to create an overriding plane and continued to dissect the anterior and then the posterior lenticule plane, taking adequate time throughout to ensure that I was dissecting within the appropriate plane. Once it was removed from the eye, I noticed some serrated edges on the lenticule. I went back to the slit beam, located the remaining piece of lenticule, and removed it.

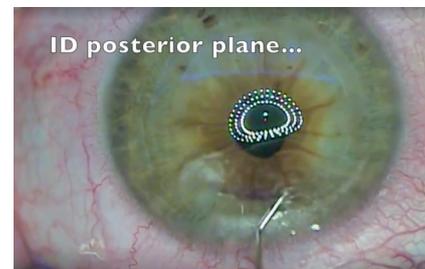
## CONCLUSION

The use of a LASIK flap for a SMILE recovery was successful in this case, and the technique helped avoid multiple incisions. The VisuMax laser (Carl Zeiss Meditec) has multiple modalities that can be used innovatively when needed.

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consistent with the results of previous studies.<sup>3,4</sup>

We are comfortable treating regular astigmatism up to the approved 6.00 D in both hyperopia and myopia. Certainly, the higher the cylinder, the more challenging it is to obtain the desired outcome. Higher cylinder ablations result in a reduced effective optical zone on some laser platforms, increasing the risks of induced glare and aberrations.

Treatment of hyperopia depends significantly on age for a number of reasons. First, in contrast to myopes, hyperopes undergo progression, especially in the postpresbyopic years. Second, after hyperopic LASIK, patients can end up with a hyperprolate cornea that can be optically unsuitable for multifocality. For these reasons, we

**TABLE. IDEAL LASIK TREATMENT RANGE USED AT ALOHA LASER VISION**

<b>Myopia</b>	Up to -8.00 D
<b>Regular Astigmatism in Hyperopia/Myopia or Mixed Astigmatism</b>	Up to 6.00 D cylinder
<b>Hyperopia</b>	Up to 3.00 D** (max keratometry no steeper than 48.00 to 50.00 D)
<b>Presbyopia</b>	Monovision, Near Eye Target Up to -1.50 to -1.75 D
**In presbyopic hyperopes who require treatment of more than +3.00 D in either eye, including near correction, LASIK distance OU or refractive lens exchange OU are preferred	

prefer RLE for hyperopic patients in the presbyopic age range.

For younger hyperopes, we are comfortable treating hyperopia up to 3.00 D, and less comfortable from 3.00 to 4.00 D. We have treated up to 6.00 D, but rarely. Some of the most successful patients we have had were highly hyperopic and with mixed cylinders, which we treat up to the full approved range. Although we do not have a minimum or flattest keratometry (K) value with myopic LASIK, we prefer to keep max K's no steeper than 48.00 to 50.00 D after hyperopic LASIK.

**PRESBYOPIA**

Numerous ablation patterns have been proposed for the treatment of presbyopia, but none have been any more successful than monovision or blended vision. We tend to favor using a myopic target of up to -1.50 to -1.75 D, usually in the nondominant eye, based on preoperative demonstration and refinement. We find that monovision is better tolerated and longer lasting in myopes than in hyperopes.

In hyperopic presbyopes, we favor RLE with trifocal IOLs as a definitive treatment of both refractive error and presbyopia. The Light Adjustable Lens (RxSight) and other lens combinations, including monovision corrections, can also be successfully used with RLE.

Although we sometimes correct only one eye in a monovision patient, it is important that the distance eye have excellent UCVA. Poor distance UCVA is a common reason patients are dissatisfied with monovision. This requires treating any hyperopia in

the distance vision eye, even if the uncorrected vision is good, because any accommodation of the distance eye also affects the near vision eye.

**SCREENING AND DETERMINING CANDIDACY**

Determining corneal health for LASIK remains an area of great challenge and controversy. Because infections and severe inflammation after LASIK are exceedingly rare, the most feared complication today is corneal ectasia.

Numerous technologies and analytical programs have been developed to identify corneas at risk for ectasia. Nonetheless, careful evaluation of corneal tomography, looking at both the anterior and posterior corneal surfaces, is still the most accepted screening method for signs of ectasia. There are some proponents of epithelial mapping<sup>5</sup> and ocular hysteresis measurement,<sup>6</sup> and there are some data to support these measures, but neither is in widespread use at this time.

Opinions and practice patterns vary, but it is widely believed that maintaining a residual stromal thickness (RST) of more than 250 µm and percentage of tissue altered (PTA) of less than 40% can reduce the risk of keratoconus.<sup>7</sup> Although there is no evidence that the 250-µm limit suggested by the FDA is not adequate, many surgeons try to maintain 300 µm as the minimum residual bed thickness. Many surgeons also limit LASIK to patients with preoperative corneal thickness greater than 500 µm, but studies have not supported increased risk based on this alone. One study found LASIK in corneas below 500 µm to be safe.<sup>8</sup>

It is important to remember that these cutoff values assume that the cornea in question is normal, without preexisting keratoconus, as most instances of post-LASIK ectasia are now thought to be due to progression of preexisting keratoconus. Because the two main risk factors for ectasia are preexisting keratoconus and removal of excess tissue, it is worthwhile to consider RST and PTA as additional data points in assessing a patient's candidacy for LASIK. These cutoff values, however, should not be taken as absolutes to be used in isolation.

Based on a 2014 analysis, Santhiago and colleagues stated that, of the risk factors they considered, a PTA of 40% or more carried the greatest risk of post-LASIK ectasia (odds ratio, 223).<sup>9</sup> In such cases, those authors said, they perform PRK. However, other studies have failed to validate these results.

Relying on Randleman's ectasia score<sup>10</sup> or using PTA or RST cutoffs alone would have disqualified many patients who have had LASIK successfully in the past, at our practice and those of other well-respected refractive surgeons. For instance, Reinstein and colleagues performed a retrospective analysis of more than 15,000 patients treated since 2002. If they had applied 40% PTA as a cutoff, they determined, 26.5% of their total database would have been denied LASIK surgery. In that database, only seven cases of ectasia had developed.<sup>11</sup>

Although we try to respect the PTA and RST safety margins, these numbers are guides and data points to be used in combination with other factors. In our opinion, careful assessment of the cornea is the most important risk factor for avoiding ectasia. For patients with mildly irregular topographies, we are comfortable performing PRK. For true keratoconus, we recommend CXL followed by ICL implantation or PRK. Studies have shown that PRK may be safe in keratoconus.<sup>12</sup>

**FURTHER SCREENINGS**

All potential LASIK patients should

be screened for DED and meibomian gland dysfunction (MGD). Patients with DED secondary to systemic disease should be assessed carefully and are more concerning. The majority of DED in potential LASIK patients, however, is MGD or limbal stem cell deficiency caused by contact lens wear.

Demonstration of changes in the meibomian glands via imaging greatly assists in counseling patients regarding the risk of postoperative symptoms. We often explain to patients with postoperative symptoms of dryness that they are recovering from both the LASIK procedure and their contact lens wear.

## OTHER ISSUES

**Breastfeeding.** Breastfeeding and pregnancy can cause refractive instability and worsened DED symptoms. We do not perform LASIK in pregnant women but will do so during breastfeeding if the patient did not have refractive changes during pregnancy. Precautions such as encouraging the patient to pump and dump their breastmilk or to avoid oral anxiolytics may be needed in these cases.

**Autoimmune disease.** Both the AAO and the FDA cite autoimmune and immunodeficiency conditions as contraindications for LASIK. However, LASIK may be reasonably safe in patients with well-controlled or inactive autoimmune disease or HIV who are otherwise good candidates. This has been our experience and has been reported by other refractive surgeons.<sup>13,14</sup> Of course, proper informed consent must be obtained.

**Diabetes.** Diabetes can cause refractive instability, but, in our experience, wound healing has not been an issue in patients with well-controlled diabetes. For those with either autoimmune disease or diabetes, we prefer LASIK over PRK.

**Glaucoma.** Patients should be informed that any corneal refractive procedure could make measuring their IOP more challenging. However, given that diagnosing and following glaucoma requires other diagnostic testing, IOP is not the only data point involved. Many

refractive surgeons will perform LASIK or PRK in glaucoma patients after a thorough discussion of the risks. Some argue that PRK is safer because it avoids the brief IOP rise during femtosecond laser flap creation and eliminates the risk of interface fluid syndrome. Practically speaking, most patients with glaucoma are older and can have their vision corrected with lens-based procedures.

**Isotretinoin.** Patients' use of isotretinoin for treatment of acne can significantly worsen postoperative DED. We prefer to wait at least 1 year after discontinuation of this medication before considering LASIK—if at all.

**Occupational issues.** Determining the patient's occupation and vocational activities is an important part of the preoperative assessment. Patients with a higher risk of direct trauma to the cornea are of the greatest concern. Specifically, this includes most martial artists and fighters. Other sports of concern include basketball and those in which finger-induced eye injuries are common.

At our practice in Hawaii, we ask our patients to remain out of the water for only 1 week. Despite the extremes of surfing, we have not seen any flap injuries or infections.

Asking about occupation and vocation also provides insights into patients' activities and may influence your choice of refractive target and furnish clues to potential postoperative issues such as prolonged screen use or other environmental issues.

## CONCLUSION

LASIK is the most commonly performed vision correction procedure in the United States. Given that most of our refractive surgical screening patients come in seeking LASIK, and that almost all have known a happy LASIK patient, there is a tendency for us to try to satisfy patients by qualifying them as LASIK candidates. That being said, however, there are times when other vision correction procedures are better.

In our practice, we have found that, when we explain the rationale for

proposing an alternative procedure—for example PRK or ICL in a patient with an abnormal cornea—patients are generally accepting and even appreciative that we prioritize their safety over convenience.

There are many fantastic procedures for correcting vision. Our goal as refractive surgeons is to make patients happy by correcting their vision safely. Choosing the right procedure for the right patient is arguably more challenging, and more nuanced, than learning to perform the surgeries themselves. We hope the guidelines outlined here will help you to make the right recommendations for your patients seeking vision correction. ■

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