

Pacific Vision Institute network includes over 200 Bay Area optometrists and ophthalmologists co-managing refractive surgery patients. Surgical co-management has grown to encompass a wide range of refractive errors, a wide range of patient ages, and an ever-expanding range of surgical procedures. Skill and knowledge transfer are essential to maintaining excellence in clinical care and patient outcomes. This issue of eFocus discusses common questions that primary eye care doctors have been asking this year. Cases are presented at the end of each discussion to illustrate the approach to patient management.

## How much astigmatism can be corrected with LASIK or PRK?

Currently FDA approved excimer lasers can be used to correct up to 6.0D of astigmatism. Astigmatism can be corrected very well with either LASIK or PRK. Several considerations need to be taken into account when deciding whether LASIK, PRK, or no corneal surgery at all is recommended for patients with high astigmatism:

- Patients with symmetric bow tie, with-the-rule astigmatism are typically excellent candidates for laser vision correction with either LASIK or PRK.
- Myopic, hyperopic, and mixed astigmatism can be corrected well with laser vision correction.
- Patients with **against-the-rule or oblique astigmatism** need to be looked at closely to insure that they have no risk factors for keratoconus. In these patients, factors such as inferior steepening and skewed radial axis need to be ruled out.
- Patients with the following findings are better candidates for **PRK rather than LASIK** 
  - inferior steepening > 1.5D
  - skewed radial axis
  - posterior float on either Orbscan or Pentacam
  - K-values > 50D

- Pachymetry < 500 microns
- Expected residual stromal bed of less than 250-300 microns
- Corneal hysteresis and corneal resistance factor measured with Ocular Response Analyzer are < 8



#### Patient B.G.

43 y.o. man referred by a San Francisco optometrist for laser vision correction.

- -0.25 5.50 x 175 (BSCVA 20/15) OD
- plano 4.75 x 180 (BSCVA 20/15) OS

Imaging workup includes: topography, Pentacam, and Ocular Response Analyzer. On Pentacam (Figure 1)– the astigmatism is symmetric and with-the-rule. There is no posterior float. Seven indices of keratoconus screening are negative. Pachymetry is normal at 525 OD and 530 OS. CH and CRF values are normal, between 10 and 11 OU.

#### Procedure Recommended: LASIK OU

#### OUTCOME: 20/15 OU

<u>TAKE AWAY POINT:</u> High astigmatism can be corrected well with LASIK. Thorough work up to confirm corneal health includes topography, Pentacam, and Ocular Response Analyzer.



Figure 1. Pentacam analysis shows symmetric astigmatism, normal corneal thickness, and normal posterior curvature.

### Why do some surgeons recommend LASIK and others PRK for the same patient?

Excellent outcomes can be achieved with both LASIK and PRK. PRK is typically recommended for patients with thin corneas (less than 500 microns), expected residual stromal bed of 250-300 microns, irregular corneas (such as inferior steepening of >1.5D or skewed radial axis), very steep corneas (> 50D), low corneal hysteresis and corneal resistance factor, and for patients with epithelial basement membrane dystrophy. There are three reasons why some surgeons may recommend one procedure over the other – screening technology, technology used to perform the actual procedures, and corneal changes induced by contact lenses.

Imaging technology, for example, that uses a camera positioned peripherally, at the limbus, rather than centrally, over the visual axis, will produce an image of the actual cornea overlying the visual axis. On the other hand, when the camera is positioned centrally, the central cornea will be blocked by the camera. The resulting image will not be the actual image, but an image that's extrapolated from the surrounding cornea imaged by the camera. Devices such as Orbscan, for example, where the camera is positioned centrally, may not produce an actual image of the cornea over the visual axis. The extrapolated image may either miss a posterior float or "detect" a posterior float where none exists. Devices such as Pentacam, on the other hand, position the camera peripherally and may represent the cornea over the visual axis more accurately.

Corneal biomechanics is becoming an increasingly important tool in determining whether LASIK or PRK is the safest option. Low corneal hysteresis and corneal resistance factor may guide a physician to recommend PRK even when traditional corneal imaging studies and pachymetry are normal.

Another reason why some physicians recommend LASIK and others PRK is their access to IntraLase femtosecond laser technology. With IntraLase femtosecond laser, we can safely create thin corneal flaps allowing us to treat large refractive errors in patients with thinner corneas. In the absence of access to this technology, PRK may be recommended instead.

And finally, certain corneal changes may be attributed to contact lens effect on the cornea rather than to an intrinsic corneal irregularity or asymmetry. If the length of time a patient was out of contact lenses prior to visiting various physicians varies, the corneal appearance may vary as well. At PVI, we recommend to the patients to be out of contact lenses for one to three weeks prior to their preoperative assessment when the procedure choice is confirmed.



#### Patient D.X.

30 y.o. woman referred by an optometrist in San Mateo

- OD -7.00 0.50 x 160 (BSCVA 20/15)
- OS -7.25 0.25 x 031 (BSCVA 20/15)
- Pachymetry 514 OD and 529 OS

Topography and Pentacam are normal (Figure 2). Although the cornea is slightly thin, thin flap LASIK would have left adequate residual stromal bed. Ocular Response Analyzer (Figure 3), however, shows very low CH and CRF values OU, suggesting corneal biomechanics measurements in the range for forme fruste keratoconus.

Procedure Recommended: PRK OU

OUTCOME: UCVA 20/20 OD and 20/15 OS

<u>TAKE AWAY POINT:</u> Ocular Response Analyzer is a useful tool in assessing corneal strength prior to refractive surgery. Corneas that are too elastic are best treated with PRK rather than LASIK to preserve corneal strength



Figure 2. Patient D.X. Topography (A) and Pentacam (B) are normal.



Figure 3. Patient D.X. Ocular Response Analyzer shows low CH and CRF values.

#### What are long term results with LASIK and PRK?

This is a question that patients ask frequently as well. We provide them with the following data. Laser vision correction has been performed for over 25 years. The outcomes have been extensively analyzed and ocular and corneal health evaluated in many peer-reviewed studies assessing long-term results. Here is the list of a few articles summarizing the results:

LASIK and PRK result in safe, predictable, and stable vision in patients followed for at least a decade (Alio JL, Ortiz D, Mufluoglu O, et al. Ten years after PRK and LASIK for moderate to high myopia (controlled-matched study). Br J Ophthalmol 2009;93(10):1313-8. Alio JL, Mufluoglu O, Ortiz D, et al. Ten-year follow up of laser in situ keratomileusis for myopia. Am J Ophthalmol 2008;145(1):46-54. Kymionis GD, Tsiklis NS, Astyrakakis N, et al. Elevenyear follow up of laser in situ keratomileusis. J Cataract Refract Surg 2007;33(2):191-6.

 LASIK and PRK have no long term effect on corneal endothelium. These corneas can be considered for use as donors for posterior lamellar keratoplasty procedures. (Patel SV, Bourne WM. Corneal endothelial cell loss nine years after excimer laser keratorefractive surgery. Arch Ophthalmol 2009;127(11):1423-27

 Posterior cornea is stable after LASIK. Ciolino JB, Khachikian SS, Cortese MJ, Belin MW. Long-term stability of posterior cornea after laser in situ keratomileusis. J Cataract Refract Surg 2007;33(8):1366-70

 Vision clarity after LASIK is the same as with long-term contact lens wear (McGee HT, Mathers WD. Laser-insitu keratomileusis versus long-term contact lens wear:decision analysis. J Cataract Refract Surg 2009;

 Based on the data submitted to FDA, LASIK and PRK are FDA approved for patients as young as 18 years old.



#### Patient C.C.

56 y.o. man referred by a Half Moon Bay optometrist for laser vision correction enhancement. Patient had LASIK OU 15 years ago to correct -12.0 diopter myopia. He did well until about a year prior when he started noticing glare at night.

• OD -1.50 -0.75 x 061 (BSCVA 20/15) Glare 20/40 • OS -0.25 -1.50 x 105 (BSCVA 20/15) Glare 20/300

Imaging workup included: topography, Pentacam, Ocular Response Analyzer, and anterior segment OCT to determine flap and residual stromal bed thickness.

On Pentacam (Figure 4) – LASIK ablation zone is noted OU. The scan looks normal. Posterior float in post refractive surgery eyes is typically an artifact of the previous corneal refractive surgery.

Corneas were clear. Nuclear sclerosis cataracts were noted with central vacuoles. Patient underwent successful cataract extraction with Crystalens implantation OU. Mild residual postoperative r refractive error in the right eye was corrected with PRK.

<u>Procedure Recommended:</u> Cataract extraction with Crystalens OU, followed by PRK OD

#### OUTCOME: 20/20 UCVA

TAKE AWAY POINT: LASIK performed 15 years ago does not alter corneal health or stability. Other ocular surgery, such as cataract surgery, for example, can be performed safely after LASIK done many years ago. Postoperative refraction can be fine tuned with additional corneal surgery.



# What is better ICL or RLE for a patient in mid 40's who is not a candidate for LASIK or PRK?

What do you recommend for an early presbyope who wants better uncorrected vision but who is not an ideal candidate for laser vision correction? Do you recommend a phakic IOL, such as ICL for example, or refractive lens exchange (RLE) with a presbyopic lens implant? As a rule of thumb, we recommend ICL for patients who have some remaining accommodation. These are patients who are typically under 50 years old. Once they lose accommodation, they can either wear reading glasses, have monovision laser vision correction, or have the phakic IOL removed followed by RLE with presbyopic IOL.



#### Patient D.S.

44 y.o. man, entrepreneur from Belvedere who found PVI on Yelp. He enjoys camping and was previously told to consider refractive surgery to improve his uncorrected vision. He presented for laser vision correction.

- OD -10.50 0.25 x 019 ds (BSCVA 20/15)
- OS -11.50 1.50 x 179 ds (BSCVA 20/15)

Imaging workup includes: topography, Pentacam, and Ocular Response Analyzer.

On Pentacam, corneal pachymetry is 527 OD and 530 OS. Anterior chamber depth 3.19 mm OD and 3.23 mm OS – adequate for ICL placement

#### PROCEDURE: ICL OU

#### OUTCOME: 20/20 UCVA OU

<u>TAKE AWAY POINT</u>: Patients with high myopia may do better with lens surgery than with corneal refractive surgery. ICL, rather than RLE, is recommended for patients with accommodative reserve. These are typically patients under 50 years old.



Figure 5. Slit lamp image of ICL well-positioned behind the iris with adequate space away from the lens.

#### What presbyopic IOL is best?

Many IOL options are available including multifocal, diffractive, and accommodating lenses. The type of IOL recommended to each patient depends on the range of vision the patient wants and whether they may tolerate potential dysphotopsis inherent in multifocal lenses. Multifocal and diffractive lenses, such as Technis and ReStor, for example, can give patiens excellent near vision but can cause potential glare and haloes in dim lighting conditions. Crystalens, on the other hand, results in excellent quality of vision both day and night as well as good near vision. For very small print, however, such as reading the medicine bottles, for example, the patients may require reading glasses. In general, we found that patients prefer excellent quality of vision even if they have to wear reading glasses occasionally to not having to wear reading glasses at all and have reduced quality of vision. Crystalens is, therefore, the preferred lens choice for most patients.

At PVI, we analyzed the outcomes of RLE with Crystalens procedures and here are the results:

- 95% 20/40 or better UCVA
- 90% J3 or better UCVA
- 2/3 of patients are within 0.50D of intended spherical equivalent postop



### Patient S.J.

60 y.o.retired woman comes from Palm Springs interested in laser vision correction. She would like to see distance and near with minimal dependence on glasses and contacts.

- MRx OD +2.00 0.50 x 095 (BSCVA 20/20) OS +1.50 – 0.50 x 060 (BSCVA 20/20)
- Imaging workup includes: topography, Pentacam, and Ocular Response Analyzer.
- All the work up is normal.

Procedure Recommended: RLE with Crystalens OU

Outcome: 20/20 OU, J1 OU

<u>TAKE AWAY POINT:</u> Presbyopic patients, even with small distance refractive error, should be considered for Refractive Lens Exchange (RLE) surgery with presbyopic lenses. Good distance and near vision can be achieved

# Is there anything new to speed up vision recovery during the initial healing period after PRK?

At Pacific Vision Institute, we have partnered with ForSight Labs, Inc in developing and testing a proprietary device to improve vision recovery after PRK. The study is open and we are recruiting patients. Study selection criteria are as follows:

- Patient is a PRK candidate
- Myopic spherical equivalent up to -6.0D
- Astigmatism up to 2.0D
- Ability to come in for follow up exam during the first four postoperative days

#### Meet Dr. Clifford Leong



We are pleased to announce that Dr. Clifford Leong recently joined PVI as a clinician and scientist who will see patients and conduct studies, including studies of devices and medications used to optimize vision recovery and comfort after PRK.

Dr. Clifford Leong was born and raised in the San Francisco Peninsula, Millbrae to be exact. He earned his Bachelor of Science Degree in Biochemistry and Cell Biology at the University of California, San Diego and his Doctorate of Optometry from the State University of New York College of Optometry in New York City. Upon graduation from optometry school, he completed a post-graduate research fellowship in Cornea and Contact Lenses at the State University of New York College of Optometry. He also worked for a prominent eye surgeon, Dr. Eric Mandel, in New York where he provided pre and post operative care for refractive surgery patients and fitted specialized contact lenses for hard-to-fit eyes. In his free time, Dr. Leong likes to travel, play basketball, snowboard and watch sports.

The device is a clear shield placed on the cornea immediately following the procedure. It is used instead of bandage contact lens and is removed on postoperative day 4, just like the bandage contact lens. Preliminary results show good vision during the postoperative healing period. For study participants, the procedure fee will be reduced by \$500 to \$1,000. Please e-mail either Dr. Faktorovich (ella@pacificvision.org) or Dr. Leong (drleong@pacificvision.org) if you have questions or would like to refer a patient.

### Pacific Vision Institute Optometric CE Program

- 10/07/10 "It's FLEX time again! Answering your patients' questions about refractive surgery" Pacific Vision Institute, San Francisco, CA
- 11/18/10 "New medications in cornea and anterior segment". Pacific Vision Institute, San Francisco, CA

### Sight Gags by Scott Lee, O.D.



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