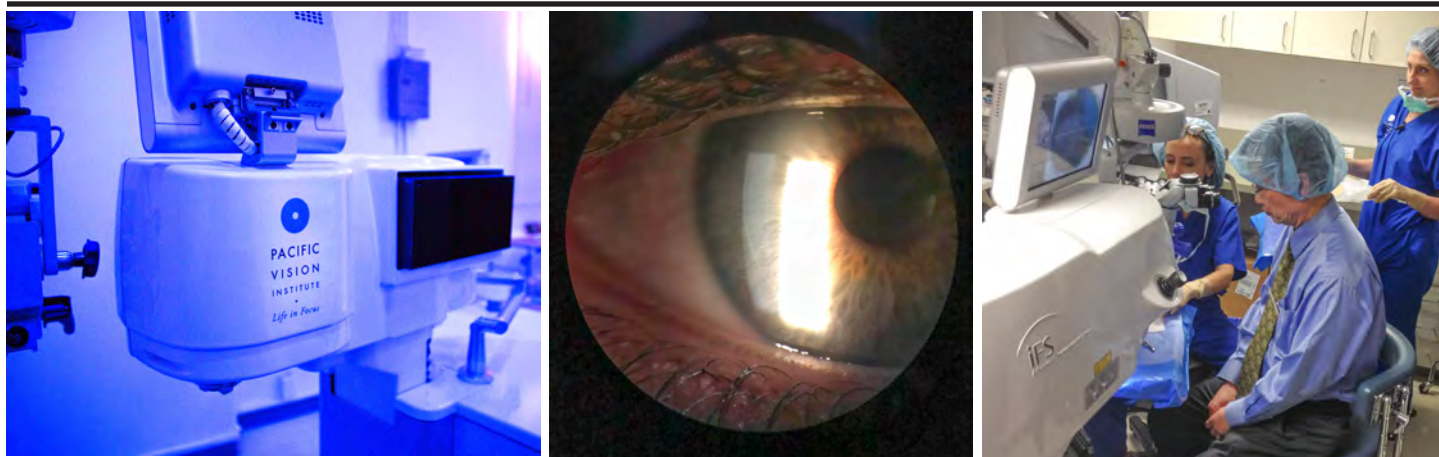




Continuing Education Events for Bay Area optometrists at Pacific Vision Institute include workshops, live LASIK surgery with IntraLase iFS® 150 5th generation femtosecond laser observation, and post op patient exams

Update on differences in safety and accuracy of femtosecond lasers used for All-Laser LASIK flap

Refractive surgery is a field that requires exceptional excellence. Nothing less than the best is acceptable for an elective procedure that must be precise, accurate and safe. Femtosecond lasers were developed to help fulfill these requirements and have changed the field. The term “All-Laser” LASIK or “IntraLASIK” has come to mean that the LASIK flap is created with a laser, a femtosecond laser, rather than a steel blade of a mechanical microkeratome. Femtosecond lasers have, in fact, transformed refractive surgery in the last several decades since the market release of the IntraLase® FS (Johnson and Johnson VISION, Santa Ana, Calif.). The bladeless flap creation rapidly gained popularity because of its promised increased safety, fast recovery and excellent results. Nowadays, the majority of refractive surgeons in the world use a femtosecond laser to create the flap. Most patients, however, are unaware that there are different types of femtosecond lasers, just like there are different types of excimer lasers, and that the safety and accuracy profiles differ among them. It is, therefore, essential to understand the major differences between these lasers so that the patients can be guided toward the safest and most accurate LASIK outcomes.

Currently, **there 5 different femtosecond lasers used for LASIK flap creation in all-laser LASIK (Table 1)**. IntraLase® FS was the first FDA-approved femtosecond laser for an all-laser LASIK flap creation in early 2000's. Over the past 20+ years, IntraLase® FS technology has undergone multiple major upgrades from its 1st generation, to 15kHz, to 30kHz, to 60kHz, to the latest, 5th Generation, 150 kHz laser, called IntraLase iFS® (Johnson and Johnson VISION, Santa Ana, Calif.).

The IntraLase iFS® laser has some obvious advantages over the previous generation IntraLase® FS 60 laser system. First, the repetition speed of 150 kHz versus 60 kHz makes the latest generation laser 2.5 times faster than the previous generation. A faster procedure indicates less time with the suction device on the eye and a generally more comfortable procedure for the patient. In addition, an inverted sidecut flap (**Figure 1**), possible only with the iFS laser, has been shown to have better flap stability

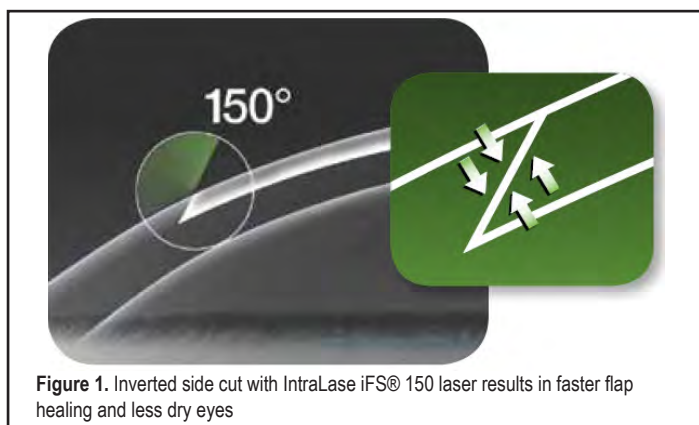


Figure 1. Inverted side cut with IntraLase iFS® 150 laser results in faster flap healing and less dry eyes

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and induce fewer symptoms of dry eye (Kung J, et al. Corneal sensation and dry eye symptoms after conventional versus inverted side-cut femtosecond LASIK: a prospective randomized study. *Ophthalmology*. 2014 Dec;121(12):2311-6.)



Figure 2. CE workshop: live surgery observation

A contra-lateral eye study conducted at Stanford University School of Medicine demonstrated significant clinical difference in the speed of visual recovery in eyes operated with IntraLase® FS 60 vs. fellow eyes operated with IntraLase iFS® 150 (Yu C, et al. Comparison of 2 femtosecond lasers for flap creation in myopic laser in situ keratomileusis: one-year results. *J Cataract Refract Surg*. 2015 Apr;41(4):740-8. At postoperative week one, 81% of eyes treated with the iFS laser had uncorrected visual acuity (UCVA) >20/16, compared to 69% in the FS 60 group ($p=0.0497$). Fewer higher-order aberrations such as coma, trefoil, and spherical aberration were detected in the iFS 150 group. Predictability also showed an advantage for the iFS 150 with more patients at emmetropia (77% vs. 61%). Overall, the iFS laser facilitates better visual results in the early postoperative

period that contribute to happier patients.

The faster visual recovery and fewer higher order aberrations after LASIK with iFS 150 is likely related to (1). Increased flap stability after surgery with iFS and (2). Exceptionally smooth stromal bed after surgery with iFS 150 (Figure 2). Laser spots are placed significantly closer with IntraLase iFS® 150 vs. IntraLase® FS 60, resulting in glass-like corneal bed smoothness and, therefore, more precise and accurate subsequent reshaping with excimer laser, leading to faster visual recovery and less higher order aberrations after LASIK with IntraLase iFS® 150.

As the IntraLase® lasers evolved, three new femtosecond laser manufacturers entered refractive surgery technology market about 10 years ago - Zeimer FEMTO LDV, Zeiss VisuMax (also used in SMILE procedures), and most recently, Wavelight FS200. These three lasers are fast, just like IntraLase iFS® 150, or even faster. However, they don't have the long track record of published results that the IntraLase lasers do. Moreover, each of these lasers has a problem yet to be solved. In Table 1, potential risks with each of these more recent technologies are highlighted in red.

Zeimer FEMTO LDV, for example, is a bulky apparatus and is difficult to fit on the eyes of patients with narrow interpallebral fissures. In such patients, a surgeon may recommend PRK, rather than LASIK, unless the surgeon also has access to one of the other femtosecond flap lasers. Most importantly, the corneal stroma after surgery with Zeimer FEMTO LDV is even rougher than after IntraLase® FS 60 (**Figure 3**). This may lead to slow visual recovery and significant higher order aberrations postop. The side cut edge is also very rough, increasing the risk of flap

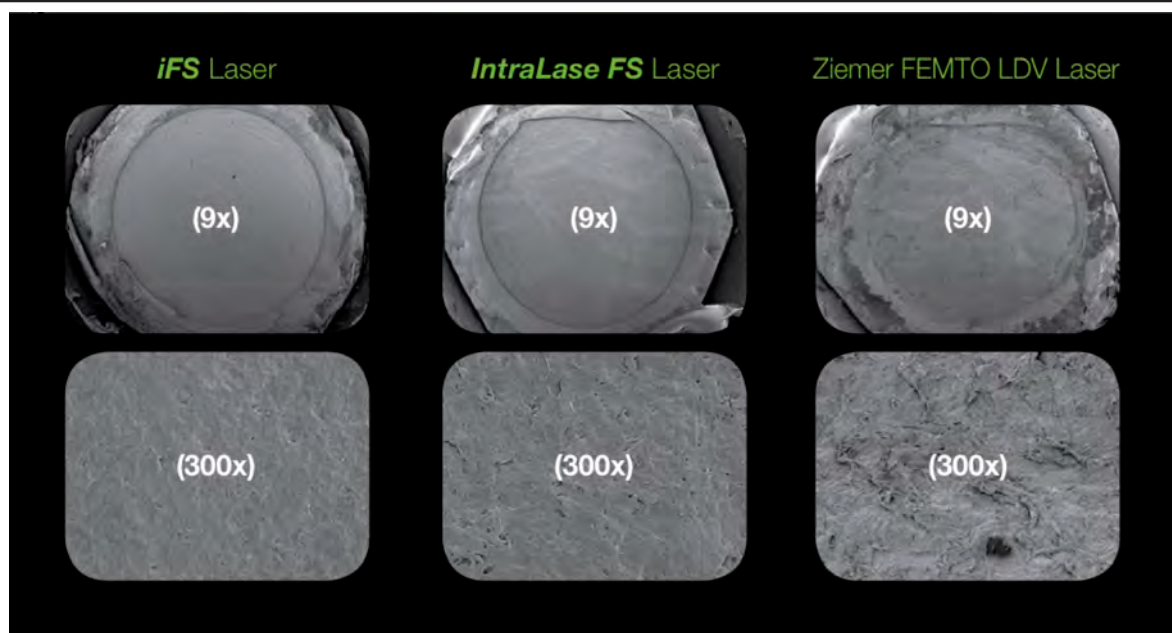


Figure 3. Scanning Electron Microscopy (SEM) comparison of corneal stroma after IntraLase iFS® 150 (iFS), IntraLase® FS 60 (IntraLase FS), and Zeimer FEMTO laser

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Table 1. Comparison of 5 different femtosecond lasers used for all-laser LASIK flap. Potential risks with each technology are highlighted in red.

	IntraLase iFS® (150 kHz)	IntraLase® FS (60 kHz)	Zeimer FEMTO LDV (Z-series)	Wavelight FS200	Zeiss VisuMax
Procedure duration	< 15 seconds	30 seconds	< 15 seconds	< 15 seconds	< 15 seconds
Precise flap centration after docking	Yes	Yes	No	No	No
Possibility of suction loss during procedure	Low	Low	Low	High	Very High
Ease of use in patients with narrow interpalpebral fissures	Easy	Easy	Difficult	Easy	Easy
Smoothness of corneal stromal bed	Very smooth	Somewhat rough	Rough	Smooth	Smooth

dislocation and epithelial ingrowth.

Wavelight FS200 and Zeiss VisuMax apply very low suction during flap creation. Although this may be more comfortable for the patient, there is a great risk of suction loss during flap resection resulting in incomplete resection, partial flap, and other potential complications that can lead to vision loss.

Until the technical issues of the newer lasers are resolved, IntraLase iFS® 150 remains the safest and most precise technology for “All-Laser” LASIK flap creation. The published studies also indicate that vision results with this 5th generation laser are superior to surgery with its predecessor, the 4th generation IntraLase iFS® 60. ■



Figure 4. CE workshop: post LASIK exam

The 2018 Nobel Prize in Physics awarded for laser technology used in femtosecond lasers

Ultra-fast Femtosecond Laser used for LASIK flap creation is an example of “chirped pulse amplification” - the scientific discovery awarded Nobel Prize in Physics this year. Femtosecond laser application in Laser Eye Surgery is detailed in Femtodynamics textbook by Dr. Ella Faktorovich, Director of Corneal and Refractive Surgery at Pacific Vision Institute. In her textbook, Dr. Faktorovich details the physics behind the laser-corneal interaction and compares currently used femtosecond lasers for “All-Laser” LASIK.

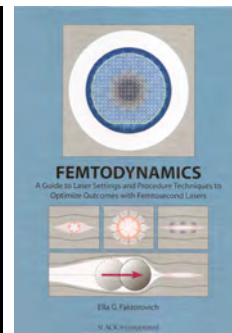
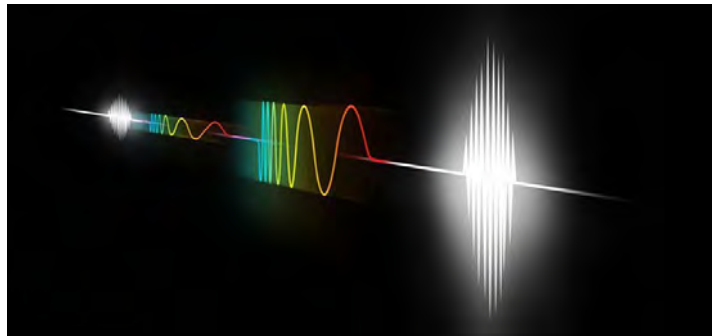


Figure 3. When laser pulses become compact, more energetic, and exist on shorter time scales, intense energy can be delivered to a precise location without damage to the surrounding matter. This is the discovery, called “chirped pulse magnification,” made by 2018 Nobel Prize winners, Gerard Mourou and Donna Strickland. This discovery made femtosecond laser eye surgery possible. Femtodynamics, a concept described by Dr. Faktorovich, details the interaction between femtosecond lasers and ocular tissue.

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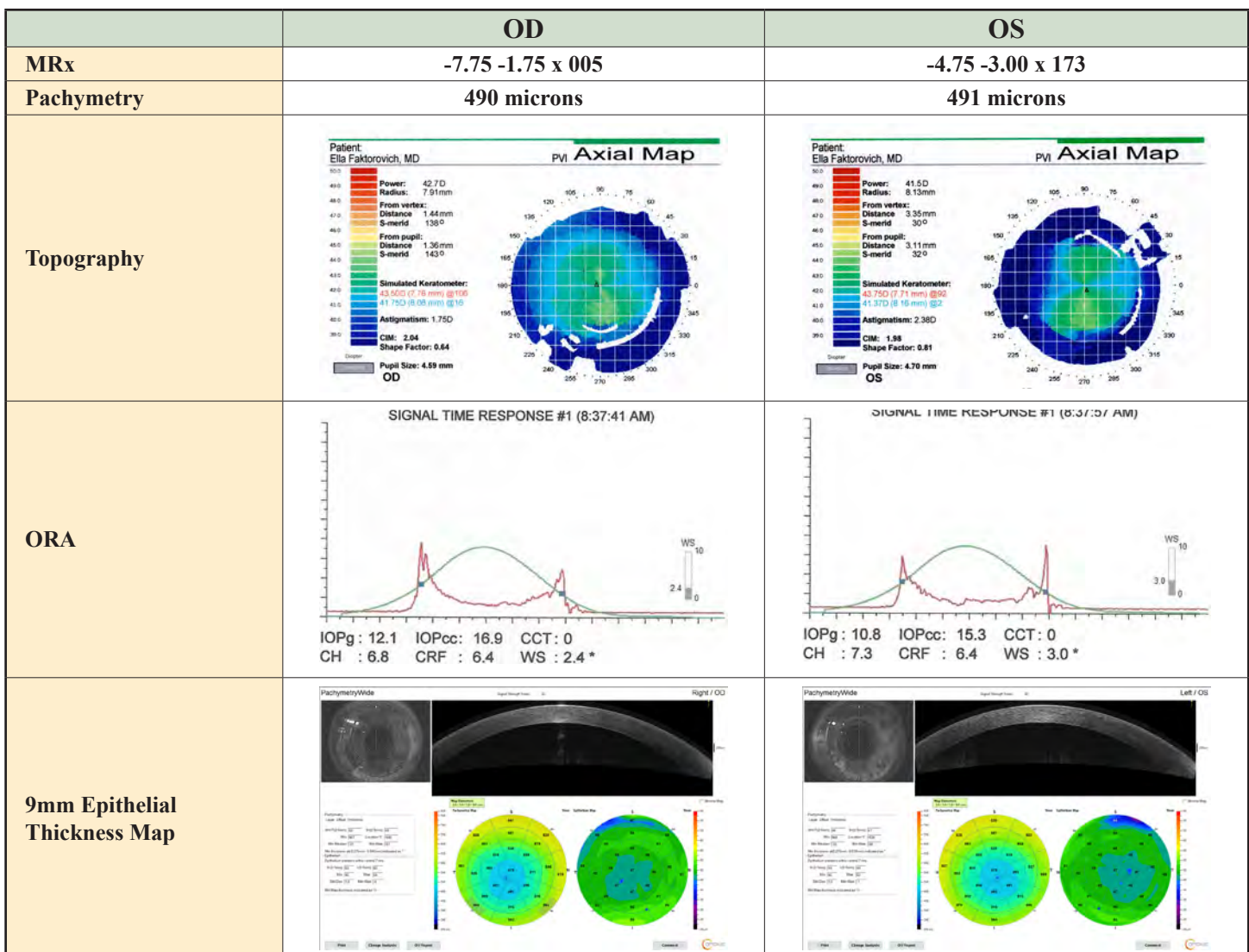
Epithelial Thickness Mapping with Optovue OCT- an important advance in refractive surgery screening

A.Y. is a 26-year old optician at Urban Eyes Optometry (Dr. Lawrence Tom) in San Francisco. She attended an Optometric Staff Training Workshop at Pacific Vision Institute and was excited to get her LASIK done. She stopped wearing contact lenses and a week later came in for a pre-operative evaluation.

The patient's topography shows symmetric but thin corneas. ORA values were low, but this can sometimes be associated with thin corneas, not necessarily weak corneas or corneas that are too flexible to undergo even PRK. At this point, we performed 9mm Epithelial Thickness Mapping with Optovue's Avanti Widefield OCT. It showed epithelial thinning overlying the

steep corneal areas. Such finding is typical for keratoconus and forme fruste keratoconus. In early keratoconus, the epithelium tries to hide the stromal cone from the front surface by thinning over the area of steepening – topography will not pick up these early cases of keratoconus. We, therefore, recommended the patient does not undergo any corneal refractive procedure at all, not even PRK, unless she has collagen crosslinking prior to it.

Recently, Pacific Vision Institute became the first practice in the Bay Area to evaluate Optovue's Avanti Widefield OCT 9mm Epithelial Thickness Mapping (ETM) in screening refractive surgery candidates (**Figure 4**). Avanti is the only commercially available system in the US with ETM. It enhance refractive



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Figure 5. LASIK Epithelial Thickness Mapping is an important part of pre-LASIK exam at PVI

surgery risk analysis, quantifies epithelial remodeling after surgery, visualizes ocular surface changes in dry eye, and detects epithelial thickening that may be associated with epithelial basement membrane dystrophy. Figure 5 shows ETM in a normal cornea, keratoconic cornea, dry eye cornea, and cornea with epithelial basement membrane dystrophy. In a recent study conducted on 1,532 myopic eyes being screened for refractive surgery with Atlas topography and Orbscan tomography, ETM ruled out keratoconus in 84% of the eyes flagged as keratoconus suspects with Atlas and Orbscan. In other words, we can exclude keratoconus in cases where stromal bulging is accompanied by epithelial thickening in the same area. At Pacific Vision Institute, we are currently conducting

a study to differentiate mild tear film instability vs. subclinical basement membrane dystrophy in patients with irregular placebo disc topography. The treatment will be different in these two groups of patients - tear film improvement in the former group, followed by LASIK; PRK in the latter group to correct the vision and improve epithelial adhesion to stroma. Epithelial Thickness Mapping is now considered the most sensitive way to differentiate normal from abnormal corneas, more sensitive than either topography or tomography. ■

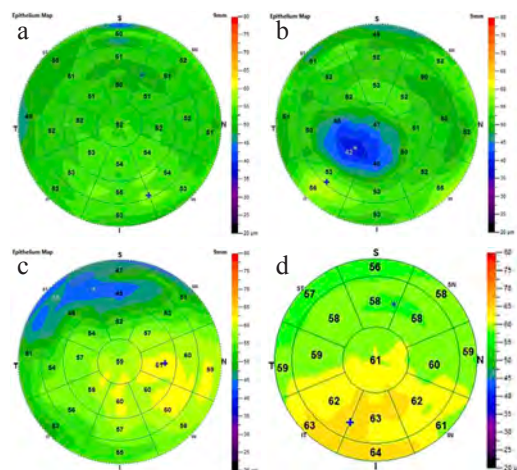


Figure 6. Epithelial Thickness Maps of (a) Normal cornea (epithelium is several microns thicker on the inferior cornea); (b) Keratoconic cornea (epithelium is thinner over the cone); (c) Dry eye (irregularly irregular pattern of epithelial thickening that may change from scan to scan); (d) Epithelial Basement Membrane Dystrophy (epithelial thickening)

Family matters

18 years ago, a PVI-affiliated optometrist at Richmond Vision Care Optometry in San Francisco, Dr. Kazemi, recommended John Koury to undergo LASIK at Pacific Vision Institute. John had an excellent result, with all his myopic astigmatism corrected to emmetropia. A year later, we did LASIK for John's wife, Anita, and referred her for her postoperative care to Richmond Vision Care Optometry. The couple was raising their 2-year old son, Sami and a 1-year old daughter, Elizabeth. Soon after Anita's LASIK, they



Elizabeth and Sami Koury on their LASIK day at PVI



Mom Anita (LASIK '01), Dad John (LASIK '00), Daughter Elizabeth (LASIK last week), Grandpa, Son Sami (LASIK last week), Dr. Ella Faktorovich (LASIK surgeon)

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decided to leave San Francisco and move to Modesto to give their kids an opportunity to grow up in slower pace, small town community. John's father, the kids's grandfather, moved with them. John told his dad that he wants only one thing from him - to spoil his kids.

Fast forward to several weeks ago. The grandfather drove a 19-year old Sami and an 18-year old Elizabeth from Modesto to Pacific Vision Institute to treat them to LASIK. LASIK is FDA-approved for patients 18 years old and older. Refractive stability

was confirmed and Dr. Faktorovich performed LASIK to correct Sami's and Elizabeth's myopic astigmatism.

"What matters most is family," said the grandfather. We agree. Over the past several decades, we've co-managed thousands of patients with our co-management family of PVI-affiliated eye doctors and, together, delivered great patient care and results. We look forward to co-managing Elizabeth and Sami with their family eye doctors in Modesto. ■

News at PVI



Pacific Vision Institute celebrates a 20-year anniversary of opening its doors in San Francisco and establishing PVI Optometric Co-Management Network. Pacific Vision Institute has been dedicated to co-management with optometric community since its inception, believing that it is in the best interest of the patient to have the benefit of an optometrist and an ophthalmologist included in the process before, during, and after LASIK surgery. Pacific Vision Institute does not have an optical dispensary, nor conducts general eye exams. Instead, we refer new patients to PVI-affiliated optometrists. Pacific Vision Institute has also always been dedicated to providing high-level continuing education programs to eye doctors to ensure the highest level of care for patients and professional collaboration. Pacific Vision Institute was one of the first in the Bay Area to co-manage LASIK, cataracts, and other vision correction procedures, and, today, it continues its commitment to the success of optometry. ■



Dr. Ella G. Faktorovich has been selected to the "America's Best Physicians" registry for 2018. Selections were made by the National Consumer Advisory Board, an organization that identifies top professionals in their fields. Doctors were chosen following an application based on training, experience, continuing education, and dedication to excellence. Doctors that satisfy all of the board's criteria can qualify for inclusion in the "Americas Best Physicians" directory.

Counselor's Corner



Q: I am considering LASIK and also trying to conceive. How should I time my LASIK procedure? Are there any special considerations if I am undergoing IVF or other fertility treatments?

A: In planning their pregnancy, most women elect to have LASIK before pregnancy rather than post-delivery, so when the baby arrives, and sleepless nights are inevitable, the new mother can easily attend to the newborn. If a woman is already pregnant, it's best to wait one to three months after delivery to have LASIK performed. Provided that a woman not pregnant at the time of the procedure, vision correction procedures can be performed while trying to conceive naturally. If a woman is undergoing fertility treatments, it

is best to wait until she is between cycles to have LASIK. Most women who have LASIK, even a week or two before getting pregnant, don't experience any changes in their vision once they become pregnant. A recent study presented at the American Academy of Ophthalmology Annual Meeting showed that pregnancy does not effect post-LASIK refractive stability.

Q: Are there any restrictions on breastfeeding after LASIK?

A: A woman can have LASIK while breastfeeding. A mild oral sedative is administered prior to the procedure. We recommend that a woman breastfeeds before taking the medication, then feed the baby with pumped milk or formula on the day of the procedure. Breastfeeding can be resumed the following day. There are several eye

drops used during the week following the procedure. By covering the tear drainage canals with a finger when applying the eye drops, a patient can help prevent the eye drops from entering the bloodstream. If she forgets this step, no worries; the amount of medication is insignificant to show up in breast milk. At Pacific Vision Institute, we have consulted with many pediatricians about the eye drops we use after the procedure, and were advised they were safe to use during breastfeeding. ■

Refractive Advisor



Q: What are absolute contraindications to LASIK?

A: Here is the list of ABSOLUTE contraindications to LASIK - keratoconus or forme fruste keratoconus or pellucid, active infection, history of herpes simplex or zoster keratitis, clinically significant cataract, Fuch's corneal dystrophy, myopic spherical equivalent greater than -12D, hyperopic spherical equivalent greater than +6D, astigmatism greater than 6D.

Q: What is the medication protocol after LASIK and for how long?

A: The patient is prescribed a topical antibiotic, a topical

steroid, and a preservative-free lubricating drop to be used after their LASIK procedure. The topical antibiotic is typically a 4th Generation cephalosporin, such as Moxifloxacin 0.5% (Vigamox) or Gatifloxacin 0.3% (Zymaxid). The steroid is Prednisolone Acetate 1% (Pred Forte). Patients need to use the antibiotic and steroid drops 4 times a day for 1 week following LASIK. They also need to use preservative free lubricating drops such as Refresh Plus, for example, every 1-2 hours for the first several weeks to one month after LASIK. Frequent computer breaks are also recommended during the first several weeks after LASIK, with patients closing their eyes for a minute or so every few hours. ■



PVI Continuing Education

LIVE SURGERY



Ongoing: Live Surgery Observation for OD Staff (includes breakfast) - please contact us at **comanagement@pacificvision.org** to schedule the date and time for your staff to attend and learn

LUNCH & LEARN

Ongoing: Lunch-and-Learn Education for OD Staff at your office (includes lunch provided by Pacific Vision Institute) - please contact us at **comanagement@pacificvision.org** to schedule the date and time for this fun and educational event for your office staff.

16th Annual San Francisco Cornea, Cataract, and Refractive Surgery Symposium - Sunday, January 27th, 2019 8 am to 5 pm at Four Seasons Hotel, San Francisco (8 hours of FREE TPA CE)

16th Annual San Francisco Cornea, Cataract, and Refractive Surgery Symposium



When - Sunday, January 27th, 2019
Where - Four Seasons Hotel, San Francisco, CA
Audience - Bay Area optometrists and select students from the graduating class at UC Berkeley School of Optometry

Overview

The San Francisco Cornea, Cataract, and Refractive Surgery Symposium - founded in 2001 - is dedicated to advancing the professions of optometry and ophthalmology through exchange of clinical and scientific knowledge and skills. The Symposium was one of the first educational events in the United States to introduce a collaborative approach to patient care by optometrists and ophthalmologists.

Over the years, more than 100 nationally renowned specialists have taught at the Symposium, including department chairs and faculty in academic centers, leaders of large practices throughout the country, scientists at major pharmaceutical and technology companies, and individuals at the forefront of business communities. The Symposium has been profiled in major optometric and ophthalmic publications, including *Primary Care Optometry News* and *Ocular Surgery News*.

The Symposium agenda for 2019 includes up-to-date topics on the use of the latest diagnostic and treatment strategies for managing ocular disease. For the first time in its 16 year history, the Symposium will also include a hands-on skill transfer workshop in techniques of ocular surface disease management. More than 150 optometrists are expected to attend.

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