PART ONE OF A FOUR-PART SERIES ON OPTIMIZING PARTNERSHIPS BETWEEN OPHTHALMOLOGY AND OPTOMETRY

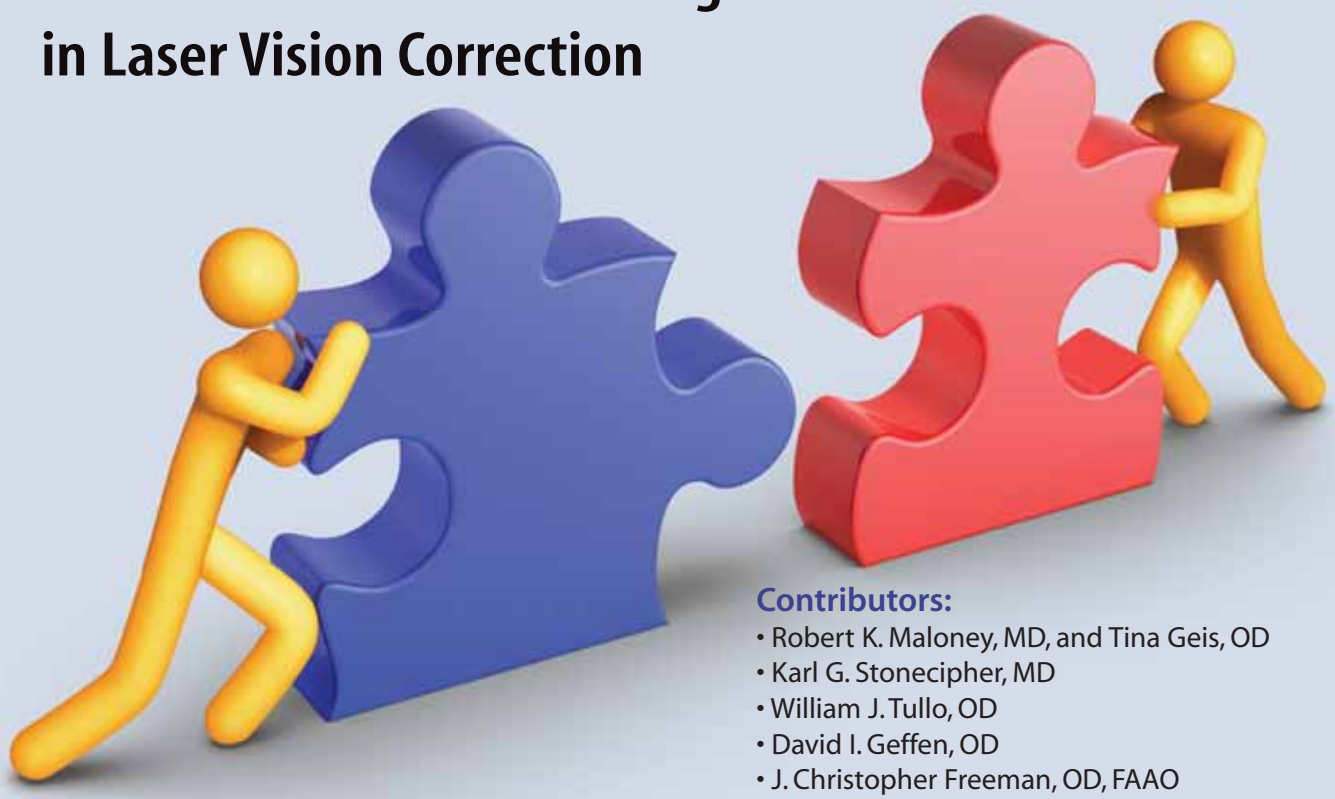
Supplement to

April 2010

Advanced
OCULAR CARE

Improving Integrated Eye Care

Collaborative Patient Management in Laser Vision Correction



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Improving Integrated Eye Care

Collaborative Patient Management in Laser Vision Correction

Part one of a four-part series

The changing landscape of health care delivery paired with a rising number of patients has led to a demand for the improved integration of ophthalmology and optometry in providing vision care. For some clinicians, this integration requires a change in paradigm, while others have already adopted a collaborative care model with success. This four-part series offers eye care professionals the tools necessary for improving the integrated delivery of care, and it provides valuable information on achieving better outcomes and enhancing patients' satisfaction.

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Defining Wavefront-Guided Procedures

The past and future of the technology.

BY ROBERT K. MALONEY, MD, AND TINA GEIS, OD

One hundred years ago, the main forms of transportation were railcars and walking. The majority of Americans lived on farms and used outhouses. Most houses had no running water, and refrigerators, central heating, and air conditioning did not yet exist. Subjective refraction, however, was performed then as it is today—by presenting a series of lenses to the patient and asking, "Which is better?" Subjective refraction measures the sphere and cylinder components of the eye's optical system by a laborious, manual method.

Today, we know that the eye can suffer defocus errors other than myopia, hyperopia, and astigmatism, including coma, spherical aberration, and distortion. Collectively termed *higher-order aberrations*, these defocus errors are not measurable by refraction. Therefore, it is possible to find patients who are perfectly emmetropic on subjective refraction, but still have blurred vision. Wavefront analysis measures these higher-order aberrations.

WAVEFRONT ANALYSIS

Astronomers have used wavefront analysis for several decades to improve the images taken by their telescopes from deep space. This method was first applied to the human eye by Prof. David Williams at the University of Rochester.[1] To measure the wavefront of a human eye, a square array of tiny lenses called a *Hartmann-Shack sensor* is used. These lenses, in essence, perform an autorefraction at each point in the pupil. In contrast, subjective refraction obtains the average refractive error over the entire pupil. By measuring the refraction at each point in the pupil, the wavefront measurement system can separate myopia, hyperopia, and astigmatism from the other causes of defocus.

DEVELOPMENT OF WAVEFRONT

Prof. Williams was able to show that, by correcting the wavefront aberrations in a human eye, it is routinely possible for patients to achieve 20/10 or 20/7 BCVA postoperatively. This led to the development of wavefront-guided laser LASIK and PRK. Wavefront systems underwent intensive FDA studies, and the results support the original promise: with wavefront-guided LASIK, about 90% to 95% of eyes achieve 20/20 vision on the first treatment, in contrast to 80% to 85% with the prior generation of conventional systems that relied on subjective refraction. Because higher-order aberrations can reduce the quality of vision and increase night glare, minimizing these aberrations is important to achieve patient satisfaction. With the Visx/AMO CustomVue system (Abbott Medical Optics Inc., Santa Ana, CA) patients in the FDA trial were more likely to be satisfied with their night vision after wavefront-guided LASIK treatment than before.[2]

APPROPRIATE CANDIDATES

There is some debate about which patients should undergo wavefront-guided treatment. Normal eyes with higher-than-average preoperative aberrations benefit from wavefront-guided treatments with a postoperative reduction in the overall aberrations.[3] Although there is no reduction in aberrations, patients with low or normal preoperative higher-order aberrations also benefit from wavefront-guided treatment because there are fewer aberrations induced than with conventional, refraction-driven treatment. In patients with a preoperative BCVA of 20/15 to 20/10, wavefront-guided treatment can reduce the chance of BCVA decreasing from 20/15 to 20/20. For this reason, many surgeons (Dr. Maloney included) gravitate toward wavefront-guided treatment for most patients.

Not everyone is a candidate for wavefront-guided treatment. In the United States, it is not currently possible to perform monovision wavefront-guided treatments, although this may change. Good wavefront maps require the pupil to be dilated to 5 mm or more. Patients with small pupils or pupils that dilate poorly usually undergo conventional LASIK treatments. Patients who have an opacity in the visual axis, such as a mild congenital cataract or a mild corneal scar, may still be good candidates for LASIK. These opacities, however, impair the ability of the wavefront analyzer to measure the eye, and therefore a subjective refraction is a better guide to treatment in these patients.

INTEGRATED CARE

Integrated eye care management of wavefront-guided patients is no different from jointly managing conventional laser patients. The routine of postoperative care does not depend on whether the treatment is wavefront-guided or not, although in our experience, fewer patients need an enhancement when wavefront-guided treatment is performed initially. We generally recommend that the

primary eye care physician leave the decision of wavefront-guided versus conventional treatment to the operating surgeon, as it may depend on factors that are difficult for the primary doctor to assess (eg, degree of media opacities and pupil dilation). It is, however, incumbent on the primary eye care provider to select a surgeon who provides outstanding quality of care and one who will use the best treatment available for each patient. ■

1. Liang J, Williams DR, Miller DT. Supernormal vision and high-resolution retinal imaging through adaptive optics. *J Opt Soc Am A Opt Image Sci Vis.* 1997;14(11):2884-2892.
2. Summary of safety and effectiveness data. For supplement premarket approval. Available at: http://www.fda.gov/ohrms/dockets/dailys/04/july04/072004/03m-0333-cr00001-02-summaryofsafety-vol1.pdf. Accessed March 26, 2010.
3. Subbaram MV, MacRae S, Slade SG, Durrie DS. Customized LASIK treatment for myopia: relationship between preoperative higher order aberrations and refractive outcome. *J Refract Surg.* 2006;22(8):746-753.

Information Gathering and Choosing a Procedure

Standardization and continuity of care between referring practices and eye care providers bring out the best in refractive surgery.

BY KARL G. STONECIPHER, MD

I work with a network of close to 300 optometrists, ophthalmologists, and other physicians who refer a steady stream of patients to my practice. Optometrists represent the vast majority of this group, about 80%. The network has developed a seamless system of integrated patient management that keeps the lines of communication open between my practice and the referring practitioners. In addition, this relationship keeps the patients informed and comfortable from the prescreening process throughout the entire postoperative period. The foundation of the integrated care process is the standardized format that all members of the network follow. Over the years, I have realized that this method is critical to getting predictable outcomes.

CONTINUITY OF CARE

Gathering and Sharing Information

A standardized form that the referring practices use to gather specific information from patients is a simple yet effective tool that I implement to keep both optometrists and ophthalmologists on the same page throughout the surgical process. Once the form is filled out, it is faxed to my office allowing me the opportunity to review it preoperatively for potential problems. Complete information from the eye examination, as well as slit lamp and fundus examination findings, are included on the form. It also lists the patients' manifest refraction, cycloplegic refraction, intraocular pressure, pachymetry, and keratometry. The form cites a candidate's complete medical history and information about his or her occupation, experience with monovision, and any prior problems with contact lenses or dry eyes. The question about occupation is key because I need to know if the surgical applicant is a truck driver or a pilot versus an accountant or a seamstress. A potential patient's profession may not be a crucial piece of information for a 28-year-old patient, however, it may complicate the surgical plan in the case of a 48-year-old patient. The more information I have in advance, the better.

Choosing a Procedure

As the number of laser refractive surgery options has grown, so has the need to effectively educate surgical candidates about these distinct procedures. For instance, patients—and eye care professionals alike—are often confused by the nuance that distinguishes wavefront-optimized from wavefront-guided laser refractive surgery.

The simple explanation is that wavefront-optimized surgery is a purely refractive treatment that minimizes the induction of spherical aberration by improving the profile of the laser ablation application to the cornea. Wavefront-guided surgery relies on a wavefront analyzer to evaluate an eye's optical system and then uses that measurement to design a treatment for that particular patient. A more complex, but perhaps meaningful explanation lies in the efficiency with which wavefront-optimized procedures are performed. Unlike in wavefront-optimized procedures, the series of measurements that are required to capture a wavefront-guided image before performing the surgery take considerable time. Sometimes, a sufficient image cannot be captured. The Allegretto Eye-Q laser (Alcon Laboratories, Inc., Fort Worth, TX) is beneficial in these cases because the device enables the surgeon to switch to a wavefront-optimized procedure instead of having to revert to a conventional treatment. Lasers that perform only wavefront-guided

Highlights of the Allegretto Wave Eye-Q

BY KARL G. STONECIPHER, MD

The Allegretto Wave Eye-Q excimer laser (Alcon Laboratories, Inc., Fort Worth, TX) represents an advanced excimer laser system that delivers wavefront-optimized, wavefront-guided, and topography-guided treatments. The topography-driven treatment procedure, called *TCAT*, is currently only available outside the United States, but its US FDA clinical trials will begin soon. Experts believe this technology has the ability to improve outcomes and postoperative quality of vision.

THE PROLATE AND ASPHERIC ABLATION PROFILE

The Allegretto Wave Eye-Q laser's consistent, high-quality outcomes are attributed to its prolate and apheric ablation profile. To maintain the ideal prolate shape to the cornea, the laser delivers more energy to the peripheral cornea than other excimer lasers, so that the correction blends into a smooth shape over the entire surface. The Allegretto's ablation profile also maintains corneal asphericity (and thus depth of focus) via a calculated Q value. The Q value describes the rate at which the curvature of the cornea changes from its center out to a set reference point, usually between 4 and 6 mm. It represents the shape of the cornea. A negative Q value equals a prolate cornea (although Q value does not describe whether or not a cornea has spherical aberration), and a prolate corneal shape has optimal optical properties.[1,2] A myopic laser correction creates an oblate cornea, which induces positive spherical aberration and degrades an eye's optics. The Allegretto Eye-Q aspheric treatment neutralizes induced positive spherical aberration in order to preserve the preoperative shape. The Eye-Q laser adjusts the wavefront-optimized treatment to reduce the amount of change in the oblate shape and maintain the cornea's natural asphericity. The excimer system customizes the treatment to the patient's refraction and keratometry to achieve the wavefront-optimized ablation pattern.

CLINICAL PERFORMANCE

Compared with other commercially available wavefront-guided laser systems, the Allegretto Eye-Q laser is faster and produces better outcomes. I have a Visx Star S4 laser (Abbott Medical Optics Inc., Santa Ana, CA) as well as several other platforms, and the Allegretto Eye-Q laser has the fastest throughput and reduces the burden on my staff. Because I treat the majority of my patients with the wavefront-optimized profile, I do not have to take pictures and do the extraneous workup involved with wavefront-guided procedures. Furthermore, the wavefront-optimized Allegretto system that I have been using since 2002 gives my patients higher-quality outcomes with a lower risk of enhancements than wavefront-guided lasers that I am currently using for a wider range of patients.

I also think the Allegretto Eye-Q laser gives surgeons tremendous value and offers superior outcomes in a short amount of time. I am impressed with the laser's predictability and quality of vision and its remarkably short learning curve. This is a laser you can start using out of the box and get good results.

Ownership of an Allegretto Eye-Q laser includes access to DataLink (SurgiVision Consultants Inc., Scottsdale, AZ), which is an asset to surgeons. DataLink is an outcomes tracking system that allows users to customize their nomograms and view the nomograms of other users. With as few as 50 eyes, a surgeon may start to build a nomogram from 0 to -7.00 D with up to 3.00 D of cylinder. Having access to this information enables an average surgeon to begin performing quality surgery with a new laser platform right away without having to worry whether the nomogram is correct. DataLink allows me to see how my outcomes are doing every month. I can compare my data to other surgeons' to see if I am performing well or if I need to make improvements.

In the FDA clinical trial, the Allegretto Eye-Q delivered results of 20/30 or better UCVA in 100% of the participants, even in eyes that required corrections of -6.00 D and greater.[3,4] Furthermore, 31% of the patients gained one line of vision. The ability to achieve 20/10 UCVAs postoperatively, I believe, depends on the patient's level of preoperative refractive error and the functionality of his visual system. I think 20/16 is regularly attainable for a large segment of patients with the Allegretto Eye-Q laser.

My staff and I saw our enhancement rate improve from 4.17% to 1.66% using the femtosecond laser and the Allegretto Eye-Q laser. When I upgraded from the 200-Hz to the 400-Hz Allegretto laser, my enhancement rate dropped again, and it is currently 0.88%.

The Allegretto Eye-Q laser delivers the future today. With the laser's wavefront-optimized profile and superb accuracy, coupled with DataLink data, I have the ability to redefine great outcomes to include 20/16 and better UCVA and to do so using a faster procedure that minimizes patients' discomfort.

1. Navarro R, González L, Hernández JL. Optics of the average normal cornea from general and canonical representations of its surface topography. *J Opt Soc Am A Opt Image Sci Vis.* 2006;23(2):219-232.
2. Calossi A.Corneal asphericity and spherical aberration. *J Refract Surg.* 2007;23(5):505-514.
3. Allegretto Wave Summary of Safety & Efffectiveness for a Premarket Approval Application. http://www.accessdata.fda.gov/cdrh_docs/pdf2/P020050S004b.pdf. Accessed September 2, 2009.
4. Stonecipher KG, Kezirian GM.Wavefront-optimized versus wavefront-guided LASIK for myopic astigmatism with the ALLEGRETTO WAVE: three-month results of a prospective FDA trial. *J Refract Surg.* 2008;24(4):S424-430.

procedures force the surgeon to either reschedule the patient to receive treatment at a facility that has a wavefront-optimized laser or revert to conventional LASIK or PRK. Performing conventional LASIK or PRK represents taking a step backward in terms of profile technology.

The two primary criteria for choosing between a wavefront-optimized and a wavefront-guided treatment are the degree of root mean square (RMS) values and the total corneal thickness. If a surgical candidate has an RMS of 0.4 µm or greater, I usually select a wavefront-guided treatment. An exception to this is in the case of patients with higher degrees of myopia, as total corneal thickness becomes an issue. In more nearsighted individuals, I will opt for a wavefront-optimized treatment even if the RMS is higher than 0.4 µm. This is because wavefront-guided treatments require the removal of more tissue, which I want to avoid. I remove less tissue in these individuals with higher myopia in case a retreatment is needed. An enhancement is only a viable option if sufficient tissue remains.

Preoperative Steps and Day of Surgery

Another tool in addition to the standardized forms that helps smooth the integrated care process is having patients view online videos of me performing LASIK and others in which I describe refractive surgery options and explain some key complicated concepts such as monovision. Patients' exposure to me in this format provides a bridge between the referral practice and their first meeting with me. Because of the standardized integrated care system that I have in place, many times patients are seeing me for the first time on the day of surgery.

Through the referring practice, I prescribe a standardized preoperative treatment regimen consisting of a corticosteroid and an antibiotic administered four times a day for 3 days before surgery. Pretreating the ocular surface helps reduce the patient's risk of having surgery cancelled because his or her eyelid margins are irritated or he or she has a compromised tear film. More importantly, pretreatment has improved my visual outcomes on postoperative day 1. Specifically, I have a documented series of approximately 6,000 patients who had better vision on the first postoperative day with pretreatment versus those who had not been pretreated. If I make changes in my pretreatment regimen, I alert all of the practitioners who refer patients to me. Communication is the key to a successful integrated care relationship.

CONCLUSION

The continuity afforded by the standardized forms, the online educational videos, and the pretreatment regimen I use helps make the patient comfortable. A content patient is in everyone's best interest. Well-treated patients refer other patients, so not only does the referring physician attract more patients, but so does the surgeon. In the end, that is really what it is all about: taking care of people, improving their vision, and making them happy. ■

Patient Selection for Laser Vision Correction

A simple mnemonic for refractive practitioners.

BY WILLIAM J. TULLO, OD

The process of selecting appropriate patients for laser vision correction is important to protect their safety, minimize complications, and maintain optimal outcomes and patient satisfaction. Criteria for patient selection comes from many sources, including published literature, FDA-approval protocols, and community guidelines. Incremental improvements in diagnostic technology, microkeratomes, and excimer lasers have all contributed to fewer surgical complications and better patient outcomes.

Due to the expense of advanced diagnostic equipment, many of the tests necessary for determining who is an appropriate laser vision candidate are no longer found in general optometry and ophthalmology practices. Therefore, patients often must visit a laser center to undergo the proper preoperative testing. The complexity and volume of preoperative screenings have made it more difficult for the general ophthalmologist and optometrist to determine whether or not a patient is an appropriate candidate for laser vision correction surgery. What follows is a simple rubric or mnemonic device, based on the word *REFRACTIVE*, that can help general ophthalmic practitioners understand the intricacies of patient selection for laser vision correction by the operating surgeon.

SELECTION CRITERA

R, Refractive Error

Refractive error determines the location and the amount of corneal tissue to be removed from the cornea. Myopic and astigmatic surgery removes the majority of corneal tissue from the central 6 mm of the cornea, and hyperopic surgery removes the majority of tissue from the peripheral 6 to 9 mm of the cornea. The FDA has set limits on refractive correction specific to both PRK and LASIK and unique to each excimer laser platform (Table 1). Currently, most surgeons will not treat in excess of -10.00 D of myopia, +4.00 D of hyperopia, and -3.00 D of astigmatism depending on the excimer laser platform used.[1] Each myopic patient must be analyzed individually depending on the laser platform (ie, microns per diopter removed), microkeratome (ie, flap thickness), and tolerance for minimal residual stromal bed thickness. Treatment for hyperopic patients is based on the number of diopters ablated rather than the amount of tissue removed.[2]

E, Extraocular Muscles

Extraocular muscles are the key to the binocular stability of vision. Eye care professionals have learned that normal binocular vision is essential to ensure safe laser vision correction. Patients who exhibit strabismus with anisometropia or apparent refractive amblyopia may be particularly disturbed by laser vision correction resulting in loss of suppression and diplopia. Ideal laser vision correction candidates exhibit normal stable binocular vision.[3] Strabismus or binocular instability are considered relative contraindications and can be screened for using standard fusion tests including cover, phoria, vergence, and stereopsis testing.

F, Family's Ocular and Systemic Health

Ocular and systemic health issues of the patient or his or her family should be unremarkable for laser vision correction. Absolute and relative contraindications vary from surgeon to surgeon (Table 2).

R, Reading Glasses for Presbyopia

Reading glasses for presbyopia can be the most difficult concept for patients to understand prior to laser vision correction. All patients, including candidates for monovision correction, must understand the eventual need for supplemental reading correction due to the progressive nature of presbyopia. Eye care professionals need to inform patients that all of their vision within arm's length will become blurry, not just reading vision. It is highly recommended that patients considering a monovision laser procedure try monovison with contact lenses or spectacles for 1 to 2 weeks before proceeding with surgery.

A, Age

Age is an important factor for both younger and older patients. Refractive stability is essential for patients' satisfaction with laser vision correction. Most experts agree that a patient's refraction must vary less than 0.50 D per year.[2,3] Because instability is more common in a young patient, the FDA stipulates that a patient must be 18 to 21 years old depending on which platform is being used (Table 1). Young patients may also be at risk for developing keratectasia after laser vision correction.[4] Older patients who suffer from loss of BCVA from either cataracts or maculopathy (eg, diabetic retinopathy, age-related macular degeneration, or retinal membranes) are poor candidates for laser vision correction. In addition to age considerations, all candidates must have the ability to understand and participate in the informed consent process.

LOOK FOR THE FOLLOWING *REFRACTIVE* FACTORS WHEN CHOOSING LASER VISION CORRECTION CANDIDATES

Refractive error
Extraocular muscles (binocularity)
Family/patient ocular/systemic health
Reading glasses (presbyopia)
Age
Corneal topography and shape
Thickness of cornea (pachymetry)
Iris (pupil diameter)
Vision (UCVA/BCVA)
Expectations

C, Corneal Topography

Corneal topography and shape analysis is the most important factor in preventing keratectasia after laser vision correction. The evolution of the technology of eye care has progressed from curvature topography, which measures the shape of the front surface of the cornea, to modern elevation topography, which can directly determine the shape of the front and back surface of the cornea (where naturally occurring keratoconus is thought to commence). During the past several years, elevation topography has become the standard for screening patients before laser vision correction because of its sensitivity and specificity for screening for corneal thinning disorders. The Pentacam (Oculus, Inc., Lynnwood, WA) uses both full corneal elevation, pachymetric data, and sophisticated normative patient databases as well as multivariant regression analysis to provide previously unavailable safety profiles for potential laser vision correction candidates (Figure 1).

Limitations of corneal shape as measured by keratometry were thought to prevent reduced quality of vision in laser vision correction patients. Myopic laser vision correction reduces keratometry about 0.70 D for every diopter ablated. Hyperopic laser vision correction increases keratometry 1.00 D for every diopter ablated. Reduced visual performance was often reported when postoperative keratometry was less than 36.00 D or more than 50.00 D. Although mod-

TABLE 1. FDA-APPROVED LASER VISION CORRECTION CRITERIA FOR PRK AND LASIK

Platform	Procedure	Myopia	Astigmatism	Hyperopia	Mixed Astigmatism	Minimum Age
Visx Star (Abbott Medical Optics Inc., Santa Ana, CA)	Conventional PRK	-12.00 D	-4.00 D	+6.00 D with up to +1.00 D astigmatism	None	18 years except hyperopia 21 years
Visx Star (Abbott Medical Optics Inc.)	Conventional LASIK	-14.00 D	-5.00 D	+5.00 D with up to +3.00 D astigmatism	None	18 years except hyperopia 21 years
Visx Star S4 IR (Abbott Medical Optics Inc.)	Wavefront-guided LASIK	-11.00 D	-3.00 D	+3.00 D with up to +2.00 D astigmatism	+5.00 D	21 years
Allegretto Wave Eye-Q (Alcon Laboratories, Inc., Fort Worth, TX)	Prolate LASIK	-12.00 D	-6.00 D	+6.00 D with up to +5.00 D astigmatism	+6.00 D	18 years except 21 years mixed astigmatism
Allegretto Wave Eye-Q (Alcon Laboratories, Inc.)	Wavefront-guided LASIK	-7.00 D	-3.00 D	None	None	18 years
Technolas 217 laser (Bausch + Lomb, Rochester, NY)	Conventional LASIK	-11.00 D	-3.00 D	+4.00 D up to +2.00 D astigmatism	None	21 years
Technolas 217 laser (Bausch + Lomb)	Wavefront-guided LASIK	-7.00 D	-3.00 D	None	None	21 years
EC-5000 (Nidek, Inc., Fremont, CA)	PRK	-13.00 D with -0.75 D astigmatism	-8.00 D with -4.00 D astigmatism	None	None	18 years except hyperopia 21 years
EC-5000 (Nidek, Inc.)	Conventional LASIK	-14.00 D	-4.00 D	+5.00 D with up to +2.00 D astigmatism	None	18 years except hyperopia 21 years
Zeiss MEL 80 (Carl Zeiss Meditec, Inc., Dublin, CA)	Prolate LASIK	-7.00 D	-3.00 D	None	None	21 years

ern, prolate-shape, controlled laser vision correction has significantly reduced (and possibly eliminated) vision complaints of myopic flattening of the cornea, hyperopic steepening beyond 50.00 D can cause dryness and loss of quality of vision due to increased eccentricity of the corneal shape.[5]

T, Thickness of the Cornea

Corneal thickness is an important factor of maintaining the structural biomechanical integrity of normal corneal shape. Initially, when LASIK was approved by the FDA, a minimal residual stromal bed thickness of 250 µm was arbitrarily chosen to prevent keratectasia.[6,7] Although keratectasia after laser vision correction is extremely rare, preserving a residual stromal bed thickness of 250 µm does not eliminate the risk of keratectasia.[8] Corneal thickness is not an independent risk factor for corneal ectasia after laser vision correction.[9] In fact, keratectasia has been reported after laser vision correction in patients with no apparent predisposing risk factors.[10]

Annual surveys of refractive surgeons show a trend toward maintaining a greater residual stromal bed thickness.[11] In 2004, 79% of surgeons respected a 250-µm minimum residual stromal bed thickness for LASIK surgery. In 2009, only 44% used the 250-µm guideline, however the majority of surgeons now use a guideline between 275- to 300-µm minimal residual stromal bed thickness.[11] The same survey showed that flap thickness creation has reduced from 150 to 160 µm in 2004, to an average of 100 µm in 2009.[11] This is due primarily to the trend toward using femtosecond laser flap creation. Minimal preoperative corneal thickness has also decreased from 500 µm in 2005, to 480 µm in 2009 for LASIK surgery. Surface ablation (eg, PRK, LASEK, and Epi-LASIK) eliminates the need to create a stromal flap allowing corneas as thin as 450 to 480 µm to safely undergo laser vision correction, depending on ablation depth.[1,11]

I, Iris Pupil Diameter

Iris pupil diameter at night (scotopic) has been implicated as one of the causes of night vision complaints (eg, glare, halos, and starbursts). Pupil size, however, is probably not the primary cause of night vision complaints.[12] Patients' complaints of night vision issues have decreased significantly as laser vision correction has evolved.[13,14] Currently, more patients report night vision complaints before modern laser vision correction than after surgery.[14] This fact is most likely due to the maintaining of the rela-

TABLE 2. LASER VISION CORRECTION CONTRAINDICATIONS

Absolute	Relative
Clinical keratoconus	Herpes zoster
Active immunosuppressive disease	Herpes simplex
Active autoimmune disease	Keloids
Active collagen vascular disease	Cataracts
Lactation	Corneal scarring
Severe dry eye	Ocular hypertension
Uncontrolled diabetes	Forme fruste keratoconus
Glaucoma with visual field loss	Monocular (less than 20/40 BCVA)
Other Contraindications	Epithelial basement membrane dystrophy
Isotretinoin	
Sumatriptan	
Amiodarone	
Immunosuppressant drugs (eg, tamoxifen, methotrexate)	
Pacemaker or defibrillator	

tive prolate shape of the preoperative cornea with modern laser algorithms. The most likely cause of night vision complaints after laser vision correction include the use of older laser algorithms with nonoptimized optical zones, a lack of adequate transitional zone sizes, and a patient's age, as well as an inability to neuronally adapt to changes in vision.[12,15]

It is recommended that all patients have their scotopic and mesopic pupil size measured preoperatively. The findings rarely affect patients' candidacy for laser vision correction with modern wavefront-guided or wavefront-optimized excimer laser platforms. Even though there is no currently available simple test to measure night vision problems before or after laser vision correction, it is important to discuss night vision symptoms with patients before surgery. The physician can ask patients to draw a picture of their digital clock viewed in a dark room before surgery to use as a baseline measure of their quality of vision at night.

V, Vision

UCVA and BCVA play an important role in patient selection for refractive surgery. Patients who have UCVA better than 20/40 and who do not wear spectacles or contact lenses for full-time distance correction (myopic or hyperopic) are often dissatisfied with laser vision correction. Patients with BCVA less than 20/40 in one eye are considered essentially monocular and are often dissatisfied postoperatively, especially if their fellow eye with BCVA 20/20 receives anything less than a perfect correction. Furthermore, patients with reduced BCVA are poor candidates for monovision laser vision correction. Small reductions in BCVA may be indicative of early forme fruste keratoconus requiring careful topographic scrutiny.

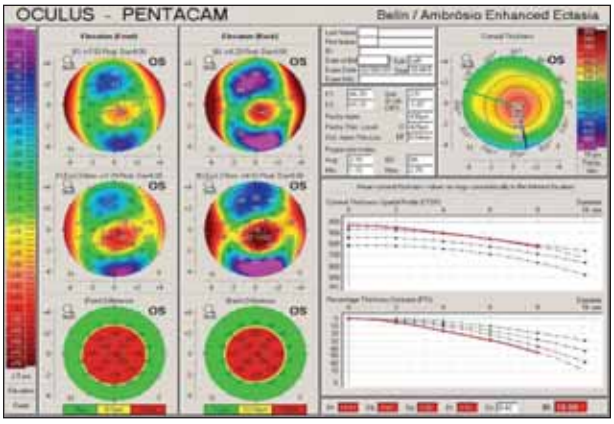


Figure 1. Enhanced ectasia display on the Pentacam.

E, Expectations

Expectations are most important to patients. A thorough understanding of patients' prospective outcomes leads to happy and satisfied patients. When patients are asked why they are considering laser vision correction, they often indicate that they want to get rid of glasses and/or contact lenses. It is very important to explain to all patients that laser vision correction can often eliminate the need for glasses and contact lenses for many, but the goal of surgery is to reduce the dependence on glasses and contact lenses. This significant distinction must be clearly defined for patients because inevitably most, if not all, patients will require part-time supplemental glasses for either reading or night driving. It is also crucial to explain that the goal of laser vision correction is not 20/20 vision, but rather "20/happy vision." Patients should be advised that, although the majority achieve vision equal to or better than they had with their glasses, both eyes are rarely exactly the same. It is significant never to guarantee a patient a perfect result. In addition, all patients who wear rigid gas permeable and hard contact lens patients should be warned that their vision after laser vision correction may not be as sharp as their contact lens vision.

CONCLUSION

The final rule is to always under promise and over deliver, which will maximize your chances of having a satisfied laser vision correction patient. ■

1. Tullo W. TLC Laser Eye Centers. 2008-2009 internal surgeon and clinical director survey.
2. Brown MC. An evidence-based approach to patient selection for laser vision correction. *J Refract Surg.* 2009;25:(7 Suppl):S661-667.
3. Steinert RF, Koch DD, Lane SS, Stulting RD. ASCRS Eye Surgery Education Council. LASIK surgery screening guidelines for patients. http://www.eyesurgeryeducation.com/Eligibility.html. Accessed April 16, 2010.
4. Tabbara KF, Korb AA. Risk factors for corneal ectasia after LASIK. *Ophthalmology* 2006;113:1618-1622.
5. Williams LB, Dave SB, Moshirfar M. Correlation of visual outcome and patient satisfaction with pre-operative Keratometry after hyperopic laser in situ keratomileusis. *J Cat Refract Surg.* 2008;34:1083-1088.
6. Joo CK, Kim TG. Cornea ectasia detected after laser in situ keratomileusis for correction of less than -12 diopters of myopia. *J Cat Refract Surg.* 2000;26(2):292-295.
7. Vinciguerra P, Camesascea FI. Prevention of corneal ectasia in laser in situ keratomileusis. *J Refract Surg.* 2001;17(Suppl):S187-189.
8. Binder PS. Ectasia after laser in situ keratomileusis. *J Cat Refract Surg.* 2003:29(12):2419-2429.
9. Binder PS. Analysis of ectasia after laser in situ keratomileusis: risk factors. *J Cat Refract Surg.* 2007;33(9):1530-1538.

10. Klein SR, Epstein RJ, Randleman JB, Stulting RD. Corneal ectasia after laser in situ keratomileusis in patients without apparent pre-operative risk factors. *Cornea.* 2006;25(4):388-403.
11. Duffy RJ, Leaming D. Trends in refractive surgery in the United States: the 2009 ISRS/AAO refractive surgery survey. Paper presented at: Refractive Surgery Subspecialty Day American Academy of Opthalmology; October 15 2009; San Francisco.
12. Klyce SD. Night vision after LASIK: the pupil proclaims innocence. *Ophthalmology.* 2004;111(1):1-2.
13. Visx Star. 2001 patient information booklet 0030-2307D. Facts you need to know about laser assisted in situ keratomileusis (LASIK) and photorefractive keratectomy (PRK) surgery.
14. VISX CustomVue. 2003 patient information booklet 0030-4129B. Facts you need to know about CustomVue laser assisted in situ keratomileusis (LASIK) laser treatment.
15. Schallhorn SC. Predicting and dealing with post-LASIK night vision problems. *Refractive Eyecare.* 2005;July:9-12.

Professions Join Forces

Ophthalmologists and optometrists unite to care for patients undergoing laser vision correction.

BY DAVID I. GEFFEN, OD

You have just completed a very thorough eye examination of a patient, and you proudly announce that his or her eyes are healthy. You are ready to escort the patient out when he or she asks, "What about my vision, doctor? Will I need new glasses?" Preposterous, you say, this would never happen in your practice. Most likely you are right, but many eye care practioners overlook the obvious task of educating patients regarding contact lenses, spectacles, and refractive surgery.

Many of my patients wonder if they are candidates for refractive surgery, and they assume they are if I do not tell them otherwise. If a friend or relative of your patient has undergone a successful laser refractive procedure and says to him or her, "You should go see my surgeon to find out if you are a candidate," you may have just lost that individual. Patients come to us as optometrists to care for their vision, and they depend on us for our expertise and recommendations. We need to educate them about all of the possible options.

A PATIENT'S INITIAL VISIT WITH AN OD

Most patients visit an optometrist for visual concerns, and they assume that we are checking the health of their eyes as well. As optometrists, however, we are likely judged by patients' visual results. If they are unsatisfied with their glasses, they often assume we are not good doctors and may seek additional care elsewhere.

We owe it to our patients to provide them with information about all of the available options for visual correction. Patients need to know whether they are candidates for contact lenses or a refractive laser correction procedure. If the patient is interested, he or she will proceed further with a conversation. I have several questions on my patient intake form about types of visual correction. If a patient shows interest in learning more about a particular procedure, I can provide him or her with a detailed explanation in terms of expectations and visual outcomes.

ODs AND MDs JOIN FORCES TO EDUCATE PATIENTS

Optometrists and ophthalmologists have many years of history together and have developed close working relationships, in part due to the evolution of refractive surgery and the structure of the current health care system. Over time, the two professions have established trust. Both groups may counsel patients and ensure that they understand the advantages and disadvantages associated with refractive surgical procedures and prepare patients to have realistic expectations.

In my practice, I use pamphlets and DVDs to educate patients. During the consultation at the end of a patient's examination, I provide a detailed description of laser vision correction surgery. I explain the procedure and discusss recovery time. Presbyopia is a confusing concept for most patients, so I discuss it in layman's terms. I offer demonstrations of monovision and use distance-only contacts. By having patients experience monovision, they get a true idea of what it entails. Furthermore, we explain the difference in today's technology in comparison with the initial procedures performed in the early 1990s. It is also important to educate the patient about the possibility of complications.

PREOPERATIVE CONSIDERATIONS

In discussing the procedures, I outline how LASIK differs from PRK and why a surgeon chooses one over the other. It is crucial to inform the patient of the possibility that he or she might not be a good candidate for refractive surgery—particularly if you do not have access to topography and pachymetry. It is embarrassing for the referring doctor to send a patient to the surgery center to have him or her turned away due to irregular or thin corneas.

It is important to know the philosophy of the surgeons with whom you are working. This helps you lead the patient in the right direction with proper expectations. Speak to the patient about the possibility of dye eyes, halos, and glare, and how proper preoperative care may help the patient to avoid these complications.

One specific example is that any sign of meibomian eye disease should be treated preoperatively. In my practice, I routinely use Azasite (Inspire Pharmaceuticals, Inc.) with hot compresses and lid massages. I prescribe a

steroid-antibiotic combination drop and doxycycline for more severe cases. I have found Restasis (Allergan, Inc.) and artificial tears to be important in the preoperative stage to help prevent postoperative dryness.

Halo and glare problems have been further minimized with today's laser technology. Developments such as customized treatments, wavefront-optimized procedures (Alcon Laboratories, Inc., Fort Worth, TX), and the IntraLase FS and iFS Laser delivery systems (Abbott Medical Optics Inc., Santa Ana, CA) have made our job much easier. Even so, I talk about possible complications and inform the patient it often takes 3 months for the healing period to stabilize.

POSTOPERATIVE VISIT SCHEDULE

I also make a point of informing patients about the schedule of postoperative visits. I stress the importance of having the patient return to the office to check on the health of their corneas as well as visual acuity. In my practice, I like to see the patient at 1 day, 2 weeks, 2 months, and 5 to 6 months postoperatively. I also discuss talk about what is covered during the postoperative time and what is not (eg, spectacles, if necessary). For example, if the patient had a monovision procedure, I review with him or her the possibility of needing spectacles to improve vision for night driving or for near vision in the long term. At each visit, it is important that you share in your patients' excitement and that you reinforce their decision to have surgery. View this as a time to strengthen your relationship with patients, and ask if there are any family members or friends who may benefit from surgery.

The excitement that a refractive surgery patient experiences is contagious. Patients will talk about it with their family, friends, and coworkers, and they will want to share this excitement with your staff as well. This is an opportunity for you to embrace refractive surgery in your practice and use it to build your patient base. You will be known as the expert and will build a new referral base.

CONCLUSION

Laser vision correction is a rewarding part of eye care practice. Make sure you are keeping abreast of new developments in technology. Working with a surgery center should be a mutually beneficial relationship, and educating your patients can be fun for you and your staff. In the current economic climate, many patients are putting off expenditures like laser vision correction. There is a pent-up demand, however, and you can be at the center of it if you take the time to educate your patients. Make them understand that you are the one to see! ■

Building an Integrated Refractive Surgery Network

How to build an enduring referral network.

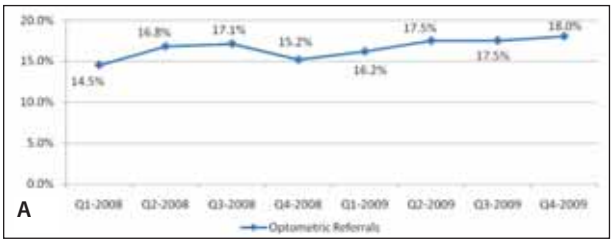
BY J. CHRISTOPHER FREEMAN, OD, FAAO

Building and maintaining a network for patient referrals is an important part of any refractive surgical practice. In a 2009 survey of surgeon members of the International Society of Refractive Surgeons, 60% of respondents reported that they participated in collaborative surgical management. Furthermore, 17% of surgeons said they jointly managed more the 50% of their refractive surgery patients.[1] According to a 2009 survey of ophthalmologists conducted by Market Scope LLC (St. Louis, MO), 18% of refractive surgery patients came from optometric referrals—the second largest source of patient referrals besides other patients (Figure 1) (D. Harmon, e-mail communication, March 2010).

The so-called Generation Y adults who are now coming of age as surgical candidates represent a large pool of patients who are already receiving routine eye care, glasses, and contact lenses from fellow eye care professionals.[2] Such referring eye doctors are a terrific source for refractive surgery patients. In a competitive market, how does an ophthalmologist acquire those referrals? This article discusses the building blocks for developing and sustaining a network of comanaging doctors.

FELLOW PHYSICIANS ARE CUSTOMERS

Many of the same principles for building a surgical practice through strong patient referrals apply to eye care colleagues who refer their patients, families, and friends for surgery. First, physicians who may refer patients for refractive surgery and jointly manage them must be considered customers and treated as such; it is important for the refractive surgeon to build and nurture a business relationship with these practitioners. Second, the concept of creating a positive and memorable patient encounter may be even more critical for comanaged patients than traditional ones. If the comanaged patient finds the surgical staff and/or the surgeon unprofessional, incompetent, or otherwise displeasing, few (if any) referrals will follow. Therefore, the surgeon must treat the referred patient as one of his or her own patients or better.



What percentage of your patients are referred from the following sources?	Q2-2009	Q2-2008	Q2-2007
Optometric Referral	18.0%	16.4%	14.5%
Other Patient Referral	49.6%	50.3%	51.0%
Employer Health Insurance Contract	6.1%	5.3%	7.4%
Radio, TV, and Newspaper Advertising	10.4%	16.2%	17.7%
Internet Website or Internet Marketing	11.8%	9.1%	6.7%
Other	4.0%	2.7%	2.8%
Total	100.0%	100.0%	100.0%

* Values weighted by procedure volume to arrive at share

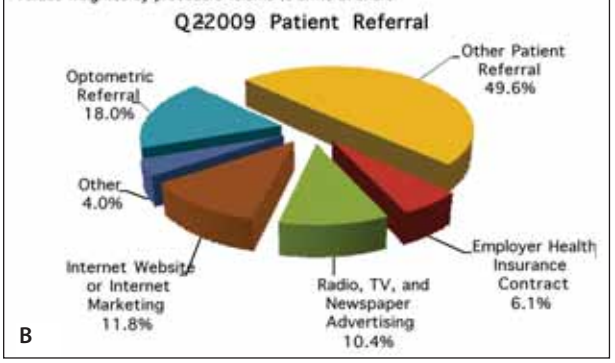


Figure 1. A 2009 survey of ophthalmologists conducted by Market Scope LLC (St. Louis, MO) found that 18% of refractive surgery patients came from optometric referrals (A)—the second largest source of patient referrals besides other patients (B).

Likewise, the comanagement experience for the referring doctor must also be positive and uncomplicated. For example, establishing a secure system to exchange patient information will put referring physicians at ease and demonstrate your commitment to the partnership.

EXCELLENT OUTCOMES

The first and foremost requirement in building a referral network is to produce superb surgical outcomes. Ultimately, high-quality patient care should be at the top of any doctor's list of criteria when considering referring a patient for surgery—particularly elective surgery. If a surgeon expects a practitioner to refer patients, he or she must be able to produce excellent surgical results with the desired visual quality and with few complications. Over time, these surgical outcomes will become apparent to referring doctors and thereby build the surgeon's reputation.

How does a surgeon convey excellent results to doctors who have not yet referred a patient to him or her? Communication by way of education or reputation is effective. A surgeon must get the word out that he or she is highly skilled at performing refractive surgery. This information may come from colleagues or from marketing messages highlighting the surgeon's results. He or she may also disseminate the information by way of personal communication, such as during a roundtable discussion or by hosting an event at which he or she presents outcomes data to a group of potential referring doctors. Without exceptional results, it will be extremely difficult to convince a doctor to refer a patient for surgery, particularly if there is another surgeon in the area who can deliver superior outcomes.

COMPETITIVE REIMBURSEMENT

Money should never be a motivating factor in caring for patients; however, it would be naïve to expect a referring doctor not to consider the amount of the reimbursement. If two surgeons produce equally good results with excellent visual acuity, minimal complications, and reported enjoyable experiences on behalf of the patients, one would not be surprised if a doctor referred patients to the surgeon whose pricing structure allowed for a higher reimbursement.

Note that extremely high payment for comanagement services may be construed as "buying" referrals or participating in illegal kickback practices. Some surgical practices may allow doctors involved in collaborative care to collect their own fees for perioperative surgical care. This arrangement can avoid any stigma associated with referrals and fee-splitting. Sometimes, reimbursement configurations become too difficult and complicated for patients and accountants and may deter doctors from referring patients.

Ongoing communication between the surgeon and the collaborative care network is imperative as in any other positive working relationship. Continuing education is one such forum for communication that is mutually beneficial to both parties in the comanagement arrangement. Doctors can earn credit hours for licensure and further their education on refractive surgery and other related eye care topics. Continuing education can benefit surgeons as well, by providing a venue in which they can educate other providers about their results, clinical practices, and patients' experiences. Large educational events offer a way to reach many doctors at once, a tactic that works well for introducing new technology or procedures. Smaller meetings, such as roundtable discussions, provide a more intimate setting to facilitate idea sharing. This format allows the surgeon and referring doctors to develop a more personal relationship that can lead to stronger business ties. Events held at the surgery center with staff present are an opportunity for referring doctors to become familiar with the surgical setting. Over time, this familiarity strengthens the bond between the surgeon, the staff of the surgery center, and the referring doctor. Inviting comanaging doctors to accompany their patients to surgery also enhances the bond between the two partners, as they can interact one on one while discussing the patient's case.

Education does not always have to take place in person, however. Modern technology makes it easy for physicians in a referral network to reach one another by e-mail and fax, in addition to traditional mail. Newsletters are a simple way of keeping referring doctors apprised of new services and tech-

nology. Clinical update bulletins with news on current events in eye care (eg, FDA approvals, recalls, and warnings) are an effective way to reach out to colleagues between newsletters and subtly remind them about the surgeon. Over time, such interaction reinforces the comfort level between the two eye care providers that strengthens the business relationship.

CONCLUSION

There is significant potential for obtaining refractive surgery referrals from fellow eye doctors. Developing and maintaining an integrated relationship may not be easy, however, especially in the beginning. It takes time to get to know eye care providers in the community, and it takes hard work to promote a surgical practice. With diligence and respect for colleagues, however, a surgeon can build a referral network that maintains—and even grows—surgical volume for both parties. Besides outstanding outcomes and competitive reimbursement, ongoing communication and education are key components of such an endeavor. The opportunity exists for surgeons to reach out to primary eye care providers to partner in the management of patients undergoing laser vision correction surgery. The doctors' and the patients' experiences during such an arrangement is as important as any customers' experience in business to generate return customers. Mutual respect, communication, and creating an impressive surgical experience for both patients and doctors will help build long-lasting professional relationships that should prove rewarding for all involved. ■

1. Duffey, R, Leaming, D. US trends in refractive surgery: the 2009 ISRS survey. Paper presented at: International Society of Refractive Surgery/American Academy of Ophthalmology Refractive Surgery Subspecialty Day; October 24, 2009; San Francisco, CA.
2. Freeman, JC, Chuck RS. The next generation of LASIK patients. *Curr Opin in Ophthalmol.* 2009;20(4):239-241.

The Future of Refractive Surgery Is Now: Presbyopic Laser Vison Correction

American surgeons are beginning to use this procedure.

BY MICHAEL GORDON, MD, AND CHARLES R. MOORE, MD

Presbyopia is a problem every middle-aged person faces. Baby boomers, who are beginning to notice or are already experiencing symptoms of presbyopia, are the fastest-growing demographic in ophthalmic surgery. Opthalmologists have not been able to completely resolve these symptoms in patients who did not need cataract surgery or could not wear monovision contact lenses. These patients are used to seeing well. Either they are former LASIK recipients who threw away their glasses 15 years ago but are starting to need them again, or they are using glasses for the first time to see their cell phones and computers, and they don't like it. Thus, the potential market for procedures that provide relief from the inconvenience and stigma of glasses is tremendous, as was the market for myopic LASIK. Many presbyopes could benefit from a procedure that can fine-tune both their distance and reading vision. Presbyopic laser vision correction may be able to meet this demand.

HOW IT WORKS

Roberto Pinelli, MD, of Italy developed presbyopic laser vision correction using the Technolas laser (Bausch + Lomb, Rochester, NY).[1] In the United States, the procedure is only available off-label on the Allegretto Wave Eye-Q laser (Alcon Laboratories, Inc., Fort Worth, TX), although several companies are exploring it. The technique evolved from the observation by many refractive surgeons that overcorrecting a myope (for example, correcting a -4.00 D myope to +1.50 D and then postoperatively enhancing the eye to make it plano) improved the reading vision in that eye beyond what was expected for the patient's age. Based on our current understanding of optics and higher-order aberrations, Dr. Pinelli realized that this effect was the result of giving the cornea a prolate shape. Negative spherical aberration increases the depth of field, which improves reading vision. Presbyopic laser vision correction does not give exactly the same reading ability as young eyes that can accommodate, however. The effect is more static; these patients cannot continually accommodate while bringing reading material in from arm's length, and they may not be able to read the smallest print. Functionally, however, the procedure effectively allows patients to read normal-sized print and view their computers and cell phones.

Presbyopic laser vision correction differs from wavefront-optimized and wavefront-guided ablations by inducing rather than eliminating aberrations. It is currently an off-label procedure that can be performed with scanning-spot excimer lasers. The authors have only applied presbyopic corrections with the Allegretto Wave Eye-Q laser, which produces a true optical zone size and subtle blend zones. This laser gives the cornea a seamless curve instead of a stepped transition seen with other lasers. We believe this smooth transition is what makes presbyopic laser vision cor-

rection with the Allegretto Eye-Q laser successful.

Presbyopic laser correction uses two FDA-approved treatments—a myopic and a hyperopic treatment—binocularly. First, we deliver a smaller myopic treatment (5.5-mm optical zone), which we overcorrect by 1.00 to 2.25 D. Then, we perform a larger hyperopic treatment (6.0-mm optical zone) to reverse the overcorrection. In hyperopes, we perform the overcorrected hyperopic treatment first, and then we fix the overcorrection with a smaller myopic treatment.

The patients we target for presbyopic laser correction treatment range from -4.00 D myopes to emmetropic presbyopes to +3.00 D hyperopes. We also use the procedure to treat 3.00 D or less of cylinder across the board with good results. Patients with asymmetric cylinder on topography are poor candidates for this treatment.

The data indicate that presbyopic laser vision correction is a stable result. Dr. Pinelli's patients in Italy are the furthest out from treatment (7 years), and their results are stable.[2]

HOW IT COMPARES TO OTHER TREATMENTS

Presbyopic laser vision correction compares favorably to monovision. Presbyopic LASIK patients generally have better distance vision than monovision patients, because both eyes are corrected for distance, and they do not experience subtle changes in depth perception. We also feel that this procedure is comparable to the presbyopia-correcting IOL technologies currently available. Ninety-five percent of our presbyopic laser vision correction recipients see 20/30 UCVA at distance and J3 at near.

Presbyopic laser vision correction may also be used as a secondary procedure to enhance the reading vision of IOL recipients. The authors have had success with the procedure in eyes with monofocal lenses. We both explain the option to patients preoperatively as a two-step procedure. Currently, the treatment range for presbyopic laser vision correction is -4.00 to +2.00 D.

Patients should be counseled that the procedure will not enable them to read J1+ print. Contraindications for presbyopic laser vision correction are the same as those for any LASIK procedure: severely dry eyes, abnormal corneal topography, and unrealistic patient expectations.

RESULTS

Dr. Gordon's

A number of refractive surgery centers around the United States have started offering presbyopic laser vision correction with promising results. My staff and I have treated more than 400 patients with presbyopic laser vision correction on the Allegretto Eye-Q laser over the past year and a half. To date, my patients' range of distance UCVA measured binocularly is 20/15 to 20/30. No patient sees worse than 20/30, no one has experienced a loss of BSCVA, and 97% see 20/25 or better at distance. Ninety-five percent of these patients read J3 or better, and 70% read J2 or better.

Dr. Moore's

My first presbyopic laser vision correction patients are nearing their 1-year outcomes. Across the board, these individuals have experienced an improvement in near vision and no lost lines of BSCVA. I have treated 165 eyes to date, of which 96% have achieved 20/25 UCVA at distance. Eighty-five percent of these patients read J3 or better, which is comparable to a multifocal lens implant. The procedure has proven to be safe and efficacious with a high level of patient satisfaction.

My enhancement rate with presbyopic laser vision correction has been higher than I would like (3.8%), because I began using the procedure without a nomogram. This rate has been falling as I continue to refine my personal nomogram. Enhancement rates with presbyopic laser vision correction average approximately 5%—slightly higher than with regular LASIK procedures, due to the newness of the procedure and the fact that it requires two ablations. Fortunately, the procedure is easy to enhance. If a patient's distance vision is not what he or she desires, we can enhance it while preserving his or her near vision, and vice versa.

Clearly, surgeons need more experience with presbyopic laser vision correction to fine-tune it. The procedure requires using different optical zones than those used in single LASIK treatments and therefore different nomograms. Also, there is a delay between the two treatments. The surgeon performs either the hyperopic or the myopic treatment first and then must recalibrate the laser, which takes 35 to 40 seconds. The surgeon must account for dehydration in the cornea during this time.

Like with any ocular surgery, surgeons and their staff must help presbyopic laser vision correction patients set realistic expectations for their outcomes. Patients must understand that the procedure has a slower healing profile than standard myopic or hyperopic LASIK; patients' vision can continue to improve up to 6 months postoperatively. Second, because people who undergo presbyopic laser vision correction are older than 50 years of age, they naturally have more problems with their ocular surface than their younger LASIK counterparts. Physicians therefore must be especially vigilant about managing dry eye and other ocular surface disease both pre- and postoperatively. We use artificial tears and nutritional supplements preoperatively. After surgery, we monitor patients' surface irregularity index and use a significant amount of artificial tears, cyclosporine, steroids, etc. We also place 90-day collagen plugs in all of our presbyopic laser vision correction patients before the procedure.

Finally, we feel it is important to use a femtosecond laser to make the flap in presbyopic laser vision correction. We believe the improved accuracy and safety profile of femtosecond flaps adds to the efficacy of these procedures. ■

1. Pinelli R, Ortiz D, Simonetto A, et al. Correction of presbyopia in hyperopia with a center-distance, paracentral-near technique using the Technolas 217z platform. *J Refract Surg.* 2008;24(5):494-500.
2. Pinelli R. More on peripheral PresbyLASIK as a center-distance technique. *J Refract Surg.* 2008;24(7):665.