

Cataract & Refractive Surgery **TODAY**

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Does Your Technology Measure Up?

How the ALLEGRETTO Eye-Q laser is equipping surgeons to deliver the next treatment paradigm in refractive laser surgery.

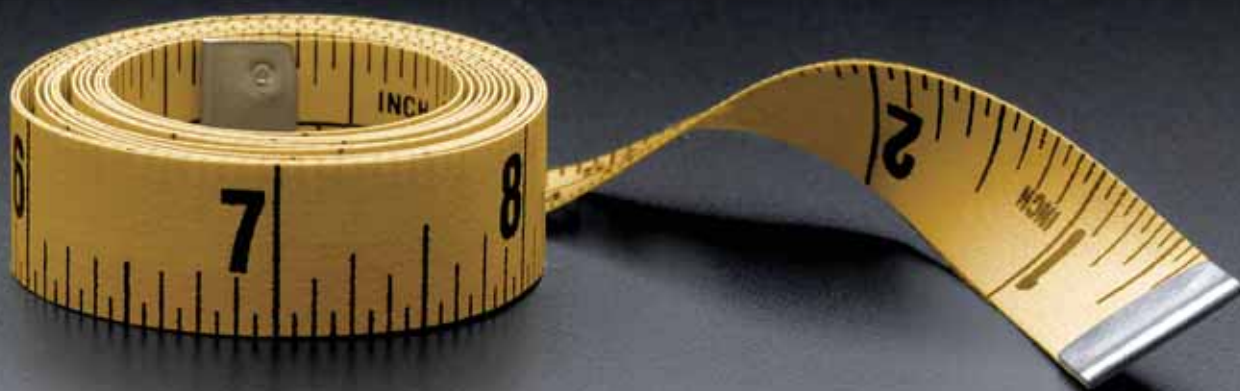
FEATURING:

Stephen S. Lane, MD

Michael Gordon, MD

Charles D. Reilly, MD

Karl G. Stonecipher, MD



PLUS: Contributions from Guy M. Kezirian, MD, and Stephen G. Slade, MD

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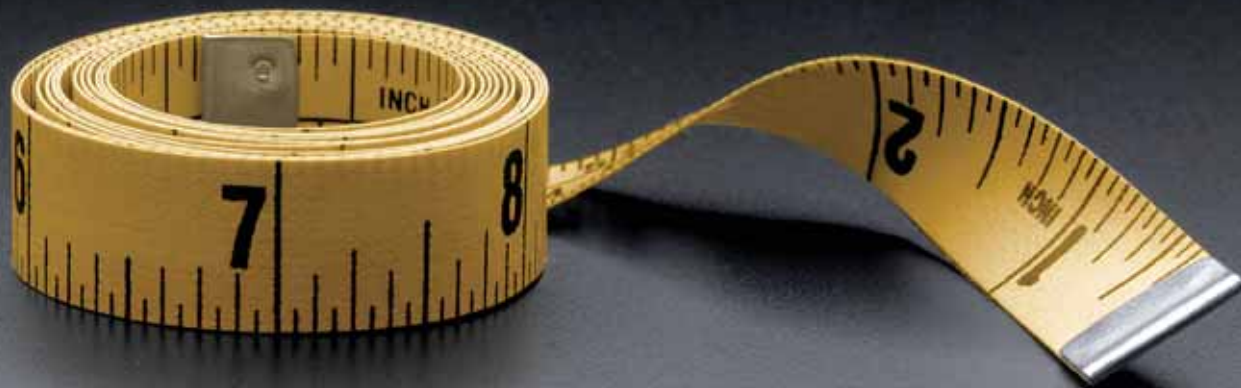
How the ALLEGRETTO Eye-Q laser is equipping surgeons to deliver the next treatment paradigm in refractive laser surgery.

Refractive surgeons now know that successful laser vision procedures depend largely on leaving the cornea with the optimal prolate shape.^{1,2} As reported on DataLink, patients are already enjoying the optical benefits of the ALLEGRETTO Eye-Q laser's aspheric ablation, which minimizes induced spherical aberrations and preserves the cornea's prolate shape.³ In addition, surgeons outside the US now have access to a third corneal treatment option that is not subject to the constraints of wavefront-guided aberrometry: topography-guided laser vision correction. In this monograph, respected surgeons experienced with the ALLEGRETTO laser platform discuss the applications and benefits of these refractive technologies.

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. Ghoreishi SM, Naderibeni A, Peyman A, et al. Aspheric profile versus wavefront-guided ablation photorefractive keratectomy for the correction of myopia using the Allegretto Eye Q. *Eur J Ophthalmol.* 2009;19(4):544-553.



Panel



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(moderator)

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Dr. Lane: The ALLEGRETTO Wave Eye-Q excimer laser (Alcon Laboratories, Inc., Fort Worth, TX) (Figure 1) represents an advanced excimer laser system that brings ophthalmologists the future today. The laser platform allows us to do things that we have not been able to do with previous laser systems, such as provide topography-guided treatments. Dr. Stonecipher, will you please begin by explaining the ALLEGRETTO Eye-Q laser's capabilities?

Dr. Stonecipher: The ALLEGRETTO Eye-Q platform features a topography-driven treatment procedure called TCAT (Figure 2). It is currently only available outside the US, but the FDA clinical trials in the US should begin soon. TCAT procedures with the ALLEGRETTO Eye-Q laser platform use computed topography to drive the treatment (as opposed to, for example, a wavefront-guided treatment that uses aberrometry to guide the treatment profile). I recently spent time with Jerry Tan, MD, in Singapore, who performs TCAT topographic ablations on 99% of his surgical patients who qualify for laser vision correction. Dr. Tan feels that this technology has improved his outcomes and his patients' quality of vision postoperatively.

Dr. Lane: I'd like to also discuss Q value and how aspheric ablations benefit patients. Dr. Gordon, will you provide an explanation?

Dr. Gordon: Q value describes the rate at which the curvature of the cornea changes from its center out to

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—Dr. Stonecipher

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 we know that 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's Eye-Q aspheric treatment neutralizes induced positive spherical aberration in order to preserve the preoperative shape.

Dr. Stonecipher: Right. 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. Because we still do not know what the perfect Q value of the cornea is, most surgeons are trying to maintain the eye's measured preoperative asphericity.

Dr. Reilly: These points are crucial in surgical planning, because the peripheral pulses that the ALLEGRETTO Eye-Q laser delivers to keep the prolate shape of the cornea are driven by the patient's keratometry. The excimer system customizes the treatment to the patient's refraction and keratometry to achieve the wavefront-optimized ablation pattern.

Dr. Lane: How do topography-guided treatments fit into the Q value, and how do they affect corneal spherical aberration?

Dr. Stonecipher: Asymmetric corneas have traditionally been the most difficult to treat with conventional procedures without potentially changing the patient's quality of vision. The ALLEGRETTO Eye-Q TCAT technology aims to improve asymmetric corneas quantitatively and qualitatively by giving them a customized shape (Figure 3). Dr. Tan has



Figure 1. The ALLEGRETTO Eye-Q laser delivers topography-guided treatments and wavefront-optimized ablations.

reported refractive success with the TCAT technology in patients who have normal eyes with asymmetric bowties who are presenting for their first LASIK or PRK procedure (unpublished data). In fact, TCAT treatments not only gives these eyes better acuity quantitatively—more 20/16 outcomes—but these eyes also see better qualitatively.

Dr. Gordon: Topography-guided excimer ablations eliminate some of the inherent negative issues of wavefront-guided ablations. These wavefront measurements are not very reproducible, and they are extremely dependent on other structures and actions in the eye such as the quality of the tear film, the lens, and accommodation. There is a wavefront component for every surface and every transition. Therefore, although excimer lasers treat the cornea, they are treating wavefront aberrations that could originate from the vitreous, the tear film, or the lens. TCAT measurements are extremely reproducible and reliable, and they only target aberrations on the cornea. These treatments remove a lot of the noise present in a wavefront-guided ablation system.

Dr. Reilly: Topography-guided excimer ablations are an exciting concept. As a cornea specialist, I have been waiting for this technology to be approved in the US, especially for use patients with highly irregular corneas. I anticipate that the benefits of topography-guided ablations will assist in producing excellent results in corneas that are deranged from prior decentered ablations, previous RK procedures, etc.

Dr. Lane: Most physicians agree that asphericity leads to better visual outcomes. How can we best discuss asphericity with our colleagues and explain it to our patients?



Figure 2. The topography custom ablation treatment (TCAT) unit of the ALLEGRETTO Eye-Q excimer laser.

“Fast patient throughput and consistent outcomes are the key benefits of the ALLEGRETTO Eye-Q laser. I also think its enhancement rates are definitely lower than other systems.”

—Dr. Gordon

Dr. Gordon: The analogy I use with patients is that a good-quality lens on a camera is aspheric. No lens that you buy for a camera is spherical, because it would produce terrible pictures. So, we do not want to introduce such poor optics to the eye. I tell patients that their eye is a camera that is attached to a computer (the brain), and in order for that camera to function as well as it can, we will give it an aspheric optic. TCAT can be explained as the aperture on the camera. Just as a camera's aperture adjusts for different lighting conditions, TCAT comes into play.

Dr. Reilly: I try to explain that asphericity is one critical element in helping our patients maximize their visual potential. For Air Force pilots, the ability to spot a gray airplane in a gray sky can mean the difference between life and death in aerial combat. Contrast sensitivity is maximized when spherical aberration is minimized, and an aspheric treatment will minimize induced spherical aberration following excimer laser ablation.

Dr. Lane: How would you explain the benefits of the ALLEGRETTO Eye-Q's optimized aspheric treatment to the surgeons who have been using a wavefront-guided laser system and been getting good results? If their patients are not complaining about their visual outcomes, why should surgeons consider switching platforms?

Dr. Stonecipher: The ALLEGRETTO Eye-Q laser is faster and produces better outcomes. I have a VISX 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 we treat the majority of our patients with the wavefront-optimized profile, we 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 enhancement than wavefront-guided lasers that I am currently using for a wider range of patients.

Dr. Gordon: I agree that fast patient throughput and consistent outcomes are the key benefits of the ALLEGRETTO Eye-Q laser. I also think its enhancement rates are definitely lower than other systems'. A large portion of a wavefront-guided treatment is wavefront optimization. The correction of higher-order aberrations is a very small component of a wavefront-guided treatment.

Dr. Stonecipher: I think the ALLEGRETTO Eye-Q laser gives surgeons tremendous value. When Dr. Gordon and I take phone calls from colleagues about a laser system, they usually are calling with questions about how to treat a particular patient or how to optimize their outcomes. A lot of the calls I get about the ALLEGRETTO Eye-Q are to tell me what wonderful outcomes the surgeon is getting with this platform in a short amount of time. They comment on the laser's predictability and quality of vision and its remarkably short learning curve. The laser and DataLink are easy to use, and the added bonus of outcomes tracking gives the laser that much more value. This is a laser you can start using out of the box and get good results.

Dr. Lane: To summarize, let's say we have a wavefront-optimized ALLEGRETTO Eye-Q system, a topography-guided system, and an optimized laser system that is not necessarily wavefront driven. How should surgeons determine what is the best modality for individual patients? What characteristics do you look for?

Dr. Gordon: Surgeons should start with the preoperative evaluation and consider all the parameters of that particular eye. Eyes that have higher-order aberrations of greater than $0.40\ \mu\text{m}$ (total RMS) may require a wavefront-guided treatment. However, surgeons also must determine if the aberrations are truly corneal. If the aberrations are lenticular, wavefront-guided treatments are not ideal. I use the ALLEGRETTO Eye-Q's wavefront-optimized treatments in 90% to 95% of my surgeries, and wavefront-guided treatments for the rest. I think wavefront-optimized ablations are more reliable and accurate than most wavefront-guided treatments.

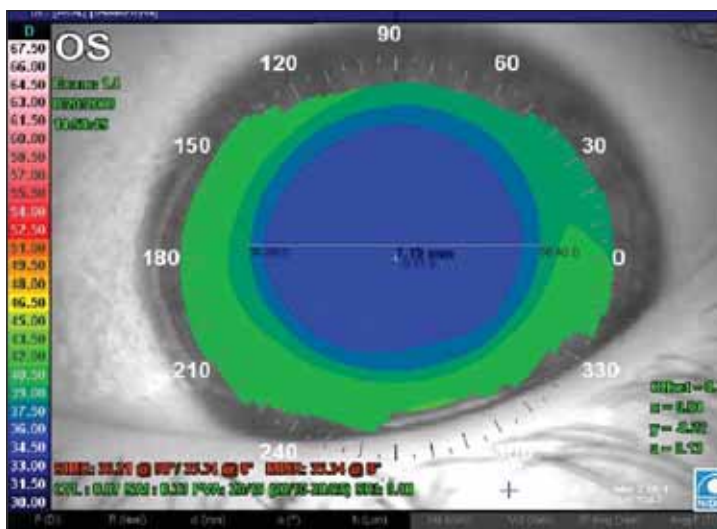


Figure 3. The TCAT procedure maintains the ideal prolate corneal shape.

Dr. Stonecipher: I completely agree. I perform topography and aberrometry on every patient, and then I interview them about their visual complaints. If the patient complains of visual symptoms in low light or at night, or if their topography shows an asymmetric bowtie, for example, I begin to consider an option other than an optimized ablation profile. Otherwise, like I said, I perform the wavefront-optimized treatments on most patients.

Dr. Lane: Is there a downside to performing a large amount of topography-guided treatments?

Dr. Stonecipher: Surgeons have to consider whether the time is worth the effort. Topography-guided treatments require some extra steps, just like wavefront-guided treatments, but they also produce a larger optical zone, which translates into a better quality of vision postoperatively.

Dr. Lane: Does it make sense from a clinical standpoint to perform aberrometry as part of the routine workup of a patient who is interested in corneal laser refractive surgery?

Dr. Stonecipher: I do not think aberrometry is necessary if you are using topography. I know surgeons who decide a course of treatment based on topography and the patient's complaints. The average ALLEGRETTO Eye-Q user performs some type of topography as part of the workup. The use of other laser platforms includes aberrometry mapping to get the appropriate treatment

profile. The ALLEGRETTO Eye-Q gives you that extra option of treatment.

Dr. Reilly: My staff and I perform aberrometry on all our patients as part of the preoperative workup. Although I do not want to overwhelm the surgical planning with too much information, I find that the combination of aberrometry with topography and a system that evaluates the elevation of both the anterior and posterior corneal surfaces provides crucial data that impacts my surgical planning. These data help me determine whether to proceed with LASIK versus a surface ablation and then to choose a wavefront-guided versus wavefront-optimized versus topography-guided ablation.

Dr. Gordon: My staff and I conduct aberrometry on every patient. This procedure adds another piece of information that helps us evaluate the patient. If the refraction correlates to our manifest and cycloplegic refractions, then we feel confident in our treatment. Or, an abnormal aberrometry can confirm a finding of significant vertical coma. Therefore, I think aberrometry is valuable in all patients.

However, I base most of my treatment decisions on conversations with the patient. Again, we have to evaluate whether visual symptoms are related to the cornea or the lens. Louis Catania, OD, once hit the nail on the head when he said in a lecture, "You can discern what higher-order aberrations a patient has preoperatively by just talking to him." If a patient complains of glare and halos, he likely has spherical aberrations. If he complains of ghost images, he probably has coma. As long as my preoperative measurements match up with the symptoms the patient describes, I proceed with my chosen treatment.

Dr. Stonecipher: I agree, and would add that if the patient has a lenticular issue, an aberrometry-guided treatment will make him worse.

Dr. Lane: Let's discuss the clinical benefits of Q value. Have either of you conducted studies comparing the pre- and postoperative effects of this technology?

Dr. Stonecipher: I am currently evaluating Q values in postcataract patients to determine how this technology correlates with better visual performance. Q values have an obvious impact on corneas that have induced spherical aberration. For example, implanting an aspheric lens in a patient who has previously undergone

"By using the 400-Hz laser, I reduce my enhancement rate and achieve more 20/20 outcomes."

—Dr. Stonecipher

hyperopic LASIK causes severe visual disturbances. We are still determining the appropriate Q values for average patients, however. For now, it is best to target real-world functional vision.

Dr. Gordon: I am also in the process of assessing Q value for my presbyopic corrections. I think Q value makes a difference when trying to create some multifocality and depth of field to allow presbyopes to read. I also think it is useful for optometrists and ophthalmologists when they fit contact lenses. Eccentricity is another form of Q; it is the square root of Q with the sign reversed. The average patient in my presbyopic series sees 20/20, and no one sees worse than 20/30. So, yes, I think negative Q value with negative spherical aberration does provide a benefit.

Dr. Stonecipher: That is an important point: presbyopic treatments create negative asphericity, which increases depth of focus for reading but also maintains good distance vision.

Dr. Lane: What Q values are you achieving? We often hear that aspherical corneas, which have no spherical aberration, achieve approximately -0.54 D.

Dr. Gordon: It can be anywhere from -0.4 to -0.9 D. We should not use Q value by itself in these circumstances, however, because it represents a shape, and we are really talking about negative versus positive spherical aberration. We also have to consider whether the patient is pseudophakic. What is the effect of the lens? What is the effect of axial length? Theo Seiler, PhD, and Michael Mrochen, PhD, are conducting work with ray-tracing, using information on the optics of the entire eye, which I think will be very interesting.

THE IMPORTANCE OF SPEED

Dr. Lane: What are the major benefits of speed in an excimer laser? What are the differences between an excimer laser that operates at 200 Hz and one that operates at 400 Hz?

Dr. Stonecipher: I recently completed a study on the differences between 200-Hz versus 400-Hz excimer lasers; the data were from -6.00 to -10.00 D of myopia with up to 3.50 D of cylinder (unpublished). The first major difference is that the 400-Hz laser is much faster; patients spend much less time underneath the laser. This gives patients less time to lose fixation, it reduces corneal dehydration, and it minimizes cyclotorsion. I think the harder patients try to concentrate on the blinking green light, the more they cyclotort. A poster presented at the 2008 ASCRS meeting showed that the longer patients are under the excimer laser, the more their fixation wanes.³ So, the faster the laser can ablate the cornea, the better. My study also found that ablation times are longer in higher myopes and in hyperopes. By using the 400-Hz laser, I reduce my enhancement rate and achieve more 20/20 outcomes. The faster laser increased my rates of ± 0.50 D, 20/20, and targeted versus achieved outcomes. I know this because the R-squared in my 400-Hz data are approximately 0.998 for sphere and cylinder. With the 200-Hz laser, my sphere was about 0.993 in this study, and my rate of cylinder was hovering at around 0.85. In essence, the 400-Hz laser is much more predictable.

DATALINK IMPROVES OUTCOMES

Dr. Lane: What outcomes have you achieved with the ALLEGRETTO Eye-Q laser compared to its clinical trial? What are your percentages of 20/15 and 20/20 outcomes?

The image shows a screenshot of the DataLink software interface. It is titled 'Patient Entry: update'. The interface is organized into a grid with four main columns for 'OD - Right Eye' and 'OS - Left Eye', each containing 'Preoperative Examination', 'Treatment', and 'Postop' sections. Each section has various input fields for patient data, including 'From Date', 'To Date', 'Status', 'Refraction', 'Target Ref', 'Treatment Data', 'Complications', 'Decided', 'Postop', and 'Follow-up'. The 'Preoperative Examination' section includes fields for 'Sph', 'Cyl', 'Axis', 'Vertex', and 'SSCVA'. The 'Treatment' section includes 'Preoperative Refraction', 'Target Refraction', 'Treatment Data', and 'Complications'. The 'Postop' section includes 'Postop Refraction', 'Target Refraction', and 'Follow-up'. The interface is designed for efficient data entry and tracking of surgical outcomes.

Figure 4. A typical DataLink screen shows the fields for inputting patient data.

"The average patient in my presbyopic series sees 20/20. So, yes, I think negative Q value with negative spherical aberration does provide a benefit."

—Dr. Gordon

Dr. Gordon: The FDA clinical trial of the 200-Hz ALLEGRETTO laser was conducted with a specific nomogram, using the laser right out of the box. The investigators reported that 61% of patients achieved UCVA's of 20/15.⁴ Clinically, most surgeons average between 60% and 70% 20/15 outcomes as reported on DataLink. Likewise, the ALLEGRETTO clinical trial's reported rate of 20/20 or better UCVA was approximately 93%, compared to an average of 96% for most practitioners. I think most surgeons would say that their ALLEGRETTO data are better than those from the clinical trials.

Dr. Stonecipher: The fact that ownership of an ALLEGRETTO Eye-Q laser includes access to DataLink (SurgiVision Consultants Inc., Scottsdale, AZ) is an underappreciated asset to surgeons. DataLink is an outcomes tracking system that allows users to customize their nomograms and view the nomograms of other users (Figure 4). With as few as 50 eyes, you can start to build a nomogram from 0 to -7.00 D with up to 3.00 D of cylinder. Having access to this kind of information enables the average surgeon to begin performing quality surgery with a new laser platform right away without having to worry whether his nomogram is correct. You can treat right out of the box.

Dr. Reilly: Because I work on an Air Force base, my staff and I had the benefit of being able to roll out the implementation of the ALLEGRETTO Eye-Q laser in a very controlled fashion. We elected to start using our laser in myopes for corrections of less than -4.00 D and cylinder of less than 2.00 D in our initial cohort of 420 eyes. The majority of our treatments were surface ablations, which is an off-label use of the laser. We did not use a nomogram in any of the treatments. Our 3-month results demonstrated that 45% of these patients achieved 20/15 or better UCVA,

THE VALUE OF DATALINK

By Guy M. Kezirian, MD



We created SurgiVision DataLink WaveLight Edition (SurgiVision Consultants Inc., Scottsdale, AZ) in 2004, just after my company secured the first FDA approvals for the WaveLight Allegretto Laser. When Alcon Laboratories, Inc. (Fort Worth, TX), acquired the distribution of the WaveLight laser platforms from WaveLight Technologie AG (Erlangen, Germany), we created SurgiVision DataLink Alcon Edition to support Alcon surgeons. Now, access to DataLink Alcon Edition is provided to surgeons using Alcon-WaveLight lasers.

I attribute much of the credit for the low enhancement rates with the Alcon WaveLight lasers to DataLink nomograms. All lasers need nomogram adjustments, and the nomograms for WaveLight lasers are very different than those for other lasers. Prior to the availability of DataLink, laser enhancement rates often averaged more than 10%.¹ With DataLink nomograms, the Eye-Q's enhancement rates average less than 2%.² Surgeons converting to a new excimer laser who do not use DataLink often experience enhancements in as many as one-third of the cases treated in the first month while they adjust their nomogram. Thanks to the DataLink nomogram, surgeons who start with Alcon WaveLight lasers—the ALLEGRETTO and the Eye-Q—are averaging 9 months before their first enhancement, and some go even longer. Thus, DataLink removes what I call “nomogram anxiety” from the process of converting to a new laser, and it allows new users to start using the laser on the right foot. Starting nomograms are provided from our database of hundreds of thousands of eyes and are refined based on surgeon outcomes very quickly; after as few as 10 cases have been entered.

I think the fact that DataLink has nearly eliminated the need for enhancements with the ALLEGRETTO and Eye-Q lasers is extremely beneficial for the marketability of laser refractive surgery. Everyone is concerned about enhancements; they spook consumers and discourage surgical staff. The majority of refractive surgical malpractice suits involve an enhancement. Along with economics, public confidence and the need for reoperations is holding back the growth of refractive surgery. Dramatically decreasing enhancement rates will boost patients' confidence in laser refractive surgery and will benefit everyone.

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1. Whitten ME. Piecing together the laser vision correction puzzle. *Cataract & Refractive Surgery Today*. 2006 Apr;6(suppl 4):6.

2. Whitten MD. Excimer laser surgery, optimized. *Cataract & Refractive Surgery Today*. March 2009;9(suppl 3):12.

and 96% achieved 20/20 or better UCVA. The remarkable thing about this achievement is that the best results for surface ablations are usually achieved 6 to 9 months after surgery, so we were excited to analyze our most recent round of data collection for those time points.

Dr. Gordon: I completely agree that access to DataLink is a major advantage of the ALLEGRETTO Eye-Q laser. Prior to DataLink, using a new laser was a little like shooting from the hip with the first few patients, because we would have to guide the treatments by the limits of someone else's nomogram. The DataLink library is a general nomogram devised from data from all DataLink users. As Dr. Stonecipher mentioned, the more you use the ALLEGRETTO and accumulate your own data, the more you can personalize your nomogram and continually modify it. Furthermore, DataLink tracks your results and compares them with those of all the other users. It is an incredibly valuable and unique tool for data tracking and analysis.

Dr. Stonecipher: DataLink allows me to see how my outcomes are doing every month. I can compare my data to the rest of the group's to see if I am performing well or if I need to make improvements.

"The percentages of 20/20 and 20/15 outcomes with the ALLEGRETTO Eye-Q laser are impressive."

—Dr. Lane

Dr. Lane: The percentages of 20/20 and 20/15 outcomes with the ALLEGRETTO Eye-Q laser are impressive. Would you say that this technology is setting a new standard for surgical outcomes? Or, is this just an incremental improvement, and optical results have a lot farther to go?

Dr. Stonecipher: 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.^{4,5} Furthermore, 31% of the patients gained one line of vision. The ability to achieve 20/10 UCVA's postoperatively, I believe, depends on the patient's level of preoperative refractive

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—Dr. Stonecipher

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.

Dr. Gordon: I agree, but I believe that reaching visual acuity beyond 20/20 may have more to do with the corneal surface and tear film than with the optical system. So many patients have a marginal tear film that will not support 20/10 vision. I think 20/16 vision is attainable, but I am not sure about 20/10 UCVA for this reason.

Dr. Lane: I agree with Dr. Gordon. Getting back to his analogy of the eye functioning like a camera hooked up to a computer, a number of studies have shown that even a perfect optical system may not necessarily impart the best vision if the brain cannot filter out unwanted images.^{6,7} The brain plays a large role in achieving very high levels of vision.

Dr. Stonecipher: Also, because people with so-called "perfect" optical systems tend to have slightly hyperopic refractions, I think these younger individuals can dial in back and forth and accommodate any changes in relationship to their spatial systems. I assume that some day, 20/10 outcomes in refractive surgery will be routine, but I think this achievement will involve optimizing other components of the optical system such as axial length or neuroadaptation.

Dr. Reilly: Physicians in the military are very interested in achieving the very best possible vision in enlisted personnel because of the obvious impact superior visual acuity plays in combat, especially in the aerospace environment. Quality of vision is equally important, however. The best measure of visual quality we currently have is contrast sensitivity. Measuring low-contrast acuity is the key to tracking excellence in outcomes. In

addition, the rate-limiting step in quality outcomes is increasingly becoming the biological system of the human eye versus qualitative improvements in the way laser ablation is performed. Modulating the corneal healing response to ensure optimal outcomes is the next frontier in refractive surgery. Such modulations may be targeted for the cornea, the lens, or a combination of the two.

ENHANCEMENTS

Dr. Lane: Do you each feel that the ALLEGRETTO Eye-Q technology has helped reduce your retreatment rates? What has been your experience?

Dr. Gordon: There is no question that compared to the LADARVision system (Alcon Laboratories, Inc.) and the VISX laser (the latter which I still have but rarely use), my enhancement rate with the ALLEGRETTO is less than half. Personally, my retreatment rates improved markedly when I transitioned from metal microkeratome blades to the IntraLase FS femtosecond laser (Abbott Medical Optics Inc.), and my rates significantly improved again when I switched to the ALLEGRETTO WAVE. My enhancement rate now hovers around 2%.

“Intraoperatively, the speed of the ALLEGRETTO Eye-Q laser is superb and greatly minimizes patients’ discomfort.”

—Dr. Gordon

Dr. Stonecipher: My staff and I saw our enhancement rate improve from 4.17% to 1.66% with using those two technologies, and I believe surgeons who use other femtosecond laser platforms have seen a similar decrease in their enhancement rates. Secondly, when I upgraded from the 200-Hz to the 400-Hz ALLEGRETTO laser, my enhancement rate dropped again, and it is currently 0.88%. I believe these two technologies—the femtosecond laser and the 400-Hz wavefront-optimized ALLEGRETTO Eye-Q laser—better preserve corneal hydration and enhance outcomes.

Dr. Gordon: My experience has been similar. My staff and I started using femtosecond technology about 8 years ago, and I presented one of the first reports of improved enhancement rates after switching from metal microkeratomes to the IntraLase. I compared our data from

the 200-Hz ALLEGRETTO laser with those from the LADARVision laser that we had used previously. Our enhancement rate was around 15% with using the combination of the LADARVision system and a standard metal microkeratome. In the first group of patients we treated with the IntraLase during the next year, our enhancement rate dropped to 8%. Since we switched to the ALLEGRETTO system after its FDA approval, our retreatment rate has stayed at approximately 2%. So, I think the ALLEGRETTO Eye-Q platform can definitely improve one’s enhancement rate significantly.

Dr. Stonecipher: Like Dr. Gordon, I still have a VISX laser in one center that I use routinely, and my retreatment rate with that machine right now is 1.67%, compared to 0.88% with my ALLEGRETTO Eye-Q laser. The time patients spend under the 400-Hz laser is so much faster per diopter of treatment that it reduces some of the extraneous variables of the surgery and tightens the nomogram.

Dr. Reilly: The most recent analysis of my team’s data demonstrates that our enhancement rate is 0.7%, but that is probably more because of the transient nature of our patient population versus any real differences in our surgical methodology. In addition, our patient population is also very healthy and has a very low incidence of ocular surface disease, a fact that probably accounts for our low rate of enhancements more than any other single factor.

FEMTOSECOND LASERS

Dr. Lane: Does femtosecond technology improve the patient’s experience in any way?

Dr. Gordon: I do not think femtosecond lasers make laser surgery any faster than bladed microkeratomes, but they do improve outcomes. I think results are more accurate with a femtosecond laser. Patients seem to prefer the idea of bladeless refractive surgery, and surgeons do not have to hold their breath to see the outcome of a femtosecond cut. I see the use of femtosecond technology as a no-brainer.

Dr. Stonecipher: I like that a femtosecond laser allows me to see what I am doing, so if there is a problem, I spot it immediately. Most femtosecond-made flaps that are interrupted can be continued to completion. This is not the case with the microkeratome; rather, surgeons must halt the procedure and wait several weeks to attempt it again.

FEMTOSECOND LASERS AND PRESBYOPIA

By Stephen G. Slade, MD



Femtosecond technology is much newer to ophthalmologists than excimer technology, and we are still learning about new potential applications of femtosecond lasers. Correcting presbyopia on the cornea is currently a large area of study. Millions of people suffer from presbyopia, and treatments so far have been tied to cataract surgery. Presbyopes who are too young for cataract surgery do not yet have a good treatment option. IntraCOR is a femtosecond technology being developed by Technolas Perfect Vision (Heidelberg, Germany) to correct presbyopia. IntraCOR involves making a set of nested cylinders suspended within the cornea (they do not cross Bowman's or Descemet's) that change its anterior curvature. Because the procedure is noninvasive, it requires no antibiotics or steroids. It is the most patient-friendly refractive procedure I know of. Thus far, the IntraCOR treatment has increased patients' reading vision without degrading their distance vision significantly, and it has received CE mark approval in Europe.

Of course, surgeons continue to investigate femtosecond technology to make cuts on the cornea, treat astigmatism, presoften or chop a cataract, and even soften the crystalline lens in an attempt to correct presbyopia. The idea of softening the crystalline lens is based on the theory that as the lens ages and loses elasticity, the ciliary muscles are less able to make it accommodate. Researchers are investigating placing patterns of femtosecond laser shots within the crystalline lens to soften it so that the ciliary muscles can change its shape and power and thereby correct presbyopia. This concept is still being explored.


Excimer lasers are also being used to change the shape of the anterior curvature of the cornea. For example, surgeons have used the ALLEGRETTO Eye-Q laser to reshape the cornea into the optically superior prolate form, increase negative asphericity, and improve the eye's depth of field. The ALLEGRETTO Eye-Q laser may provide some benefit in this application over some other lasers because it may offer a smoother transition zone in the cornea's periphery. I am optimistic that the role of femtosecond lasers in ophthalmology will continue to expand, with applications in refractive surgery, presbyopia correction, and cataract surgery.

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Dr. Reilly: In my hands, I think the femtosecond laser slows down the actual surgical time of a bilateral treatment by about 2 minutes. Nevertheless, if you want high precision and results of exceptional quality in LASIK, then a femtosecond laser appears to be more capable of delivering those results than a mechanical microkeratome. The safety factor of the femtosecond laser cannot be overstated. A recent analysis of our data demonstrated statistically identical outcomes in femtosecond-assisted LASIK where an intra- or postoperative complication was noted compared to when no complication occurred.

Dr. Lane: Do you perceive any disadvantages with femtosecond lasers?

Dr. Gordon: The only potential drawback with femtosecond lasers is their cost, and I think the technology pays for itself in the long run with its improvement in accuracy, fewer enhancements, and word-of-mouth referrals from patients who had a pleasant experience. In this way, I think femtosecond lasers can help build a practice.



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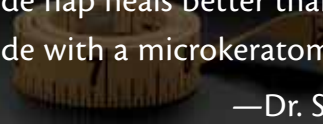
Dr. Reilly: The larger footprint, cost, and additional training for surgeons and staff are certainly disadvantages to the technology, but it is a small cost compared to the benefits of using the femtosecond laser.

Dr. Lane: In terms of enhancements, some surgeons have mentioned having difficulty relifting a femtosecond flap as compared to a microkeratome flap. Have you experienced this?

Dr. Gordon: I find relifting femtosecond flaps only marginally more difficult than relifting microkeratome flaps. I am starting to see patients for enhancements who received femtosecond-made flaps 7 to 8 years ago, and I do not have a problem relifting them with the technique I use.

Dr. Lane: What would you say to physicians who are doing PRK enhancements because they are nervous about relifting the femtosecond-made flap?

Dr. Gordon: I think that fear is misguided. As I said, relifting femtosecond-made flaps is not difficult, but



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you cannot use the same technique that you use for microkeratome-made flaps. For the latter, I would sit the patient at the slit lamp and use a 27- or 30-gauge needle to lift the edge of the flap. Then, I would move the patient underneath the laser to sweep the flap back with a spatula. This approach does not work with a femtosecond flap, because the angle is 70° or less, which is hard to get underneath at the slit lamp. So, I bring the patient back under the laser. I use a Sinskey hook to find the edge of the flap, and then I slide the hook under the edge and lift it slightly. Then, I use a spatula to sweep the flap back, just like with a microkeratome-made flap. This technique is very simple, and it works extremely well. I have never encountered a flap I could not lift, no matter how it was made.

Dr. Stonecipher: I agree with Schmack’s data,⁸ which showed that an IntraLase-made flap heals better than one made with a microkeratome. However, a few studies have indicated that after 2 to 3 years, both types of flaps experience increased epithelial ingrowth if re-lifted.^{9,10} It is not clear whether this epithelial ingrowth is due to the healing factor, lifting technique, or something else, but after this amount of time, I may elect to perform a PRK enhancement instead.

Dr. Reilly: I agree with Dr. Stonecipher. In general, the amount of surface ablation performed in the US is growing each year, so more surgeons are becoming increasingly comfortable managing the expectations of PRK patients. I find performing PRK enhancements over femtosecond flaps very predictable and reliable; I have not had any complications as a result of this procedure to date. Again, it is important to point out that surface ablation is an off-label use of the ALLEGRETTO Eye-Q laser.

Dr. Gordon: I am also aware of that increased risk of epithelial ingrowth, particularly in hyperopic patients. I do not think myopic patients are as susceptible to epithelial ingrowth after relifting the flap, particularly if the flap is well centered.

Dr. Stonecipher: The incidence seems to correlate with the patient's postoperative refraction. If the outcome is myopic, I may perform a transepithelial surface treatment. If the outcome is hyperopic or includes mixed astigmatism, I am more willing to relift the flap, because these types of eyes need a 6.5- X 9-mm optical zone.

Dr. Lane: I have found exactly the same thing. I used to relift a microkeratome flap the same way, by cutting down on it with a 27-gauge needle that could lift the flap's edge. I do have more difficulty using the same technique with femtosecond-made flaps, so I also bring these patients back under the ALLEGRETTO Eye-Q laser. I can skip the step at the slit lamp, and it is easy to find a femtosecond-created flap's edge under the laser's slit beam.

PRACTICE EFFICIENCY

Dr. Lane: How does the ALLEGRETTO Eye-Q laser improve your patient throughput and patients' overall comfort on the day of surgery?

Dr. Gordon: There is no question that the ALLEGRETTO laser has improved my throughput compared to other systems, particularly because the wavefront-optimized profile is such an excellent platform on which to treat patients. Being able to eliminate the step of taking wavefront measurements saves a lot of time. Intraoperatively, the speed of the ALLEGRETTO Eye-Q laser is superb and greatly minimizes patients' discomfort.

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Dr. Stonecipher: The speed of the femtosecond laser has reduced patient throughput as well; creating the flap now takes 10 to 12 seconds. Patients' time underneath the laser makes the real difference in throughput, however. Patients begin to get nervous when they are asked to gaze at the green blinking light, because they are afraid of losing focus and compromising the ablation. The 400-Hz ALLEGRETTO Eye-Q platform is so

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fast that the length of time patients have to hold focus is very brief. Every day, I hear ALLEGRETTO patients say, "Are you done? Is that it?"

Dr. Reilly: We routinely schedule 20 patients to treat in the morning of a surgical day. Because of the speed of the ALLEGRETTO Eye-Q laser, I can usually start treating at 8:00 AM and finish by 10:30 AM. The laser's speed is amazing, but more important than speed is the ability to deliver good results.

ECONOMICS

Dr. Lane: How are you maintaining your surgical volumes in these slower economic times?

Dr. Gordon: We have to market ourselves and provide good service. Ten years ago, it was enough to market every iteration of new technology. Consumers have become more sophisticated, however, so I think we surgeons have to market ourselves and the experience and the benefits of laser vision correction. We must provide a level of service commensurate with the image we want to have, and we have to learn to charge fair prices for our services. Aside from money, the biggest reason people shun surgical practices is fear. We can offer payment packages to address the money issue, but we can only address their fears through personal attention. The best way to alleviate patients' fears is to treat them with exceptional service when they visit our offices. Moreover, we can put our patients at ease by talking with them one-on-one, answering their questions, and explaining how great our technology is and how easy their surgery will be. We need to take the time to explain how accurate the laser's tracker is so they do not have to worry about their eye moving, and the fact that femtosecond laser technology does not use a blade. All of these strategies help to alleviate patients' concerns, and I believe they will sustain our practices in hard times.

Dr. Stonecipher: First, I believe that negative marketing among surgeons in competing markets has hurt our

specialty as a whole. Personally, my practice has had success this year with marketing to college-aged individuals, people who are between 19 and 22 years old, because they are less affected by the recession. We placed ads in the campus newspapers at the major universities in North Carolina and beefed up our Internet marketing efforts to target this population. However, this age group expects a service-oriented experience with elective surgery, so I try to create a fun atmosphere. My technicians and I converse and joke with our patients, and I make it a goal on every postoperative day 1 to hear the patient say he or she enjoyed the experience. And I do—every day, patients comment, “I applaud your staff, because from beginning to end, I felt comfortable.” We have to remember that patients have a choice of where they go for surgery. For example, I recently treated a patient who was referred to me by an optometrist with whom I have had a long relationship. This optometrist told the patient to schedule surgery wherever he felt most comfortable, so the patient visited my practice and also a few discount providers. When he returned to the optometrist and was asked which practice he chose, he said, “I really felt comfortable with the treatment I got in Dr. Stonecipher’s center. They talked to me, they treated me like a real person, and they took the time to explain everything to me.” So, to Dr. Gordon’s point, this patient did not make his decision based on price or technology. In the end, this patient enjoyed his experience.

Dr. Reilly: We in the military are uniquely positioned. When the economy sours in the civilian sector, we see a bump in our practices, primarily because the option of military service becomes more attractive in tough economic times. We have to compete with other interests for budget dollars, however, so it is important that we consistently demonstrate the value of the service we are delivering. That cannot be overstated. Our men and women in uniform deserve the very best outcomes, because the results of their surgery can often mean the difference between life or death.

SUMMARY

Dr. Lane: There is no doubt in my mind that service is the name of the game today. I think patients deserve service that is commensurate with the money they are paying out of pocket. Further, although consumers may

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not know the intricacies of particular technologies, the concepts of *faster* and *safer* still appeal to them. I think we all agree that the ALLEGRETTO Eye-Q laser delivers the future today. With the laser’s wavefront-optimized profile and superb accuracy, coupled with DataLink data, we are redefining great outcomes to include 20/16 and better UCVA, and to do so in a faster procedure that minimizes patients’ discomfort.

Another exciting development is the new modality of topography-guided ablations, which may allow us to treat specific visual problems. Finally, the ALLEGRETTO Eye-Q laser brings a new level of efficiency to our practices and allows us to treat more patients in the service-oriented manner in which they should be treated. Overall, the laser helps patients feel good about their experience with their surgeons, and it helps physicians feel confident about their outcomes. ■

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