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**Excimer Laser Surgery,**

# OPTIMIZED

Surgeons are adopting the ALLEGRETTO  
WAVE Eye-Q laser for the efficiency,  
safety, and undeniable results of its  
wavefront-optimized ablations.

**Excimer Laser Surgery,**

# **OPTIMIZED**

Learn why longtime users of other excimer laser platforms are switching to the ALLEGRETTO WAVE Eye-Q laser.

## Contents

- 3 Wavefront-Optimized Ablation Equals Grade "A" Work**  
Why a multicenter practice switched to the ALLEGRETTO WAVE Eye-Q excimer laser.  
By James A. Davison, MD, FACS
- 6 Optimized Surgery**  
How the ALLEGRETTO WAVE Eye-Q excimer laser's efficient wavefront-optimized technology translates into consistently impressive results.  
By Gary R. Tylock, MD
- 8 Separating Truth From Hype**  
Rely on data and unbiased recommendations when choosing a laser technology.  
By Roy S. Rubinfeld, MD
- 10 Superior Performance and Outcomes**  
Switching from the VISX platform to the ALLEGRETTO WAVE Eye-Q excimer laser.  
By Michael Y. Wong, MD
- 12 Improving Outcomes With the ALLEGRETTO WAVE Eye-Q**  
How the laser's performance, coupled with DataLink tracking, has refined my results.  
By Mark E. Whitten, MD





# Wavefront-Optimized Ablation Equals Grade "A" Work

Why a multicenter practice switched to the ALLEGRETTO WAVE Eye-Q excimer laser.

BY JAMES A. DAVISON, MD, FACS

I work in a large practice, which comprises seven main offices that cover most of the central portion of Iowa. We have seven refractive surgeons and two refractive surgical sites. Our impetus for exploring the acquisition of the ALLEGRETTO WAVE Eye-Q excimer laser (Alcon Laboratories, Inc., Fort Worth, TX) was a combination of disappointment with our wavefront-guided treatments using the LADARVision4000 laser (Alcon Laboratories, Inc.), previously attempted wavefront-guided experience resulting in our necessary but reluctant satisfaction with conventional treatments with the Technolas 217 laser (Bausch & Lomb, Rochester, NY), word-of-mouth recommendations about the ALLEGRETTO WAVE Eye-Q, and data from FDA trials and ophthalmic literature supporting the system's wavefront-optimized profile.<sup>1-6</sup>

## COMPELLING CLINICAL TRIAL DATA

In the FDA's 2003 study of the ALLEGRETTO WAVE excimer laser, its 1-year retreatment rate was 3.7% for myopia<sup>1</sup> and 5.5% for hyperopia.<sup>2</sup> The 2006 FDA study compared the ALLEGRETTO's wavefront-guided module against its wavefront-optimized module. At the 3-month follow-up, there



Figure 1. Dr. Davison with one of Wolfe Eye Clinic's ALLEGRETTO WAVE Eye-Q excimer lasers.

"In the FDA's 2003 study of the ALLEGRETTO WAVE excimer laser, its 1-year retreatment rate was 3.7% for myopia and 5.5% for hyperopia."

were no retreatments required in either group. At 6 months, 2.7% of patients in the wavefront-guided group needed a retreatment, but still none in the wavefront-optimized group.<sup>3</sup> Meanwhile, although the numbers are not completely comparable, our practice's rolling average retreatment rate in 2006 was 12% for wavefront-guided LASIK with the LADARVision4000 and 14% for conventional LASIK with the Technolas 217 laser. As we read more reports about the advantages of the wavefront-optimized technology, we began talking to friends who were already using it. Furthermore, although our patients were ultimately happy with their results from our previous lasers, the imprecision of our product required a significant number of them to endure a retreatment session, and everything associated with it, to achieve that satisfaction. We wanted to improve our service to our patients by reducing their risk of having to undergo retreatment.

The combination of FDA studies, post-FDA studies, and the testimonials of colleagues convinced us to make the commitment to adopt the ALLEGRETTO WAVE Eye-Q excimer laser (Figure 1) in September 2007 in our Cedar Rapids office, where we had the LADARVision4000 laser.

## FIRST IMPRESSIONS

At first, we kept the Technolas 217 laser in our West Des Moines clinic because its royalty card price per patient was so low for conventional LASIK compared with the ALLEGRETTO WAVE Eye-Q's price that it was still cheaper to run it and tolerate the higher retreatment rate than if we would have reduced that rate to 2% with the ALLEGRETTO WAVE

Eye-Q laser. Once we began using the ALLEGRETTO WAVE Eye-Q in Cedar Rapids, however, we could see that it was a superior product that delivered superior results. It performed better, our patients were happier, and the quality of their postoperative vision was better. Our experience corroborated the ALLEGRETTO WAVE Eye-Q's FDA study results, and after several discussions, we realized that we could no longer justify providing surgery with the Technolas laser. We replaced it with another ALLEGRETTO WAVE Eye-Q laser in August 2008. We believed in the technology so much that we now have two of these lasers.

## SIGNIFICANTLY IMPROVED RETREATMENT RATES

Currently, our 3-month lag retreatment rates are 2.2% in Cedar Rapids and 4.3% in West Des Moines, and I think the latter will continue to improve as our nomograms stabilize. These figures are startlingly better than the 12% and 14% we had with the LADARVision4000 and Technolas, respectively. They are especially good considering that my colleagues and I are generous when it comes to doing retreatments; we do not try to talk patients out of it if we know a retreatment will improve their vision and make them happier. My criterion for determining which eyes are good candidates for an initial excimer ablation is whether I can leave 275 to 300  $\mu\text{m}$  of stromal tissue in the bed and affect only 43% of the cornea with the flap and the treatment combined. This strategy allows for the possibility of a secondary treatment while always preserving 250  $\mu\text{m}$  of tissue in the base and only affecting 50% of the cornea with flap creation and excimer ablation. My typical enhancement is about -0.25 to 0.50 D at some axis and 20/25 vision, but if the patient wants even better vision and I am confident I can provide it for him, I will re-treat per the request. When you fix an eye with a small residual refractive error, the patient leaves extremely happy. All this considered, I am very pleased that I do not have to enhance as often using the ALLEGRETTO WAVE Eye-Q technology.

## PATIENT SATISFACTION

For flap creation, we've used the IntraLase FS femtosecond laser (Abbott Medical Optics, Inc., Santa Ana, CA) exclusively since 2002, and I have not noticed a significant difference in the appearance of patients' eyes immediately postoperatively between the ALLEGRETTO WAVE Eye-Q and our previous lasers. What matters most, however, is how each patient's vision appears on the first postoperative day. With the new ALLEGRETTO WAVE Eye-Q laser, virtually everyone is happy with their postoperative vision,

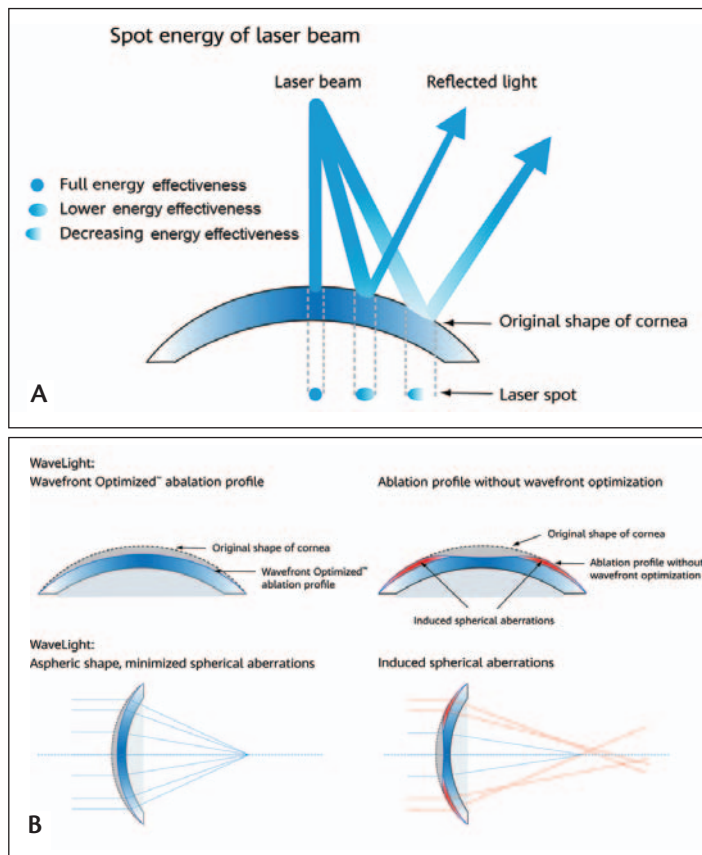


Figure 2. Due to the angle of incidence (A), the light of the laser beam is ovalized increasingly toward the periphery and becomes partially absorbed, which results in less fluence and thus suboptimal ablation (B).

and we no longer see the occasional unhappy patient when we walk in the exam room on the first day after surgery.

## BEHIND THE BETTER RESULTS

I attribute the ALLEGRETTO WAVE Eye-Q laser's superior outcomes to two of its unique features: the wavefront-optimized profile and the speed with which its pulses are delivered. The wavefront-optimized profile induces less spherical aberration by distributing relatively more treatment spots in the optical zone periphery and the transition zone, thereby preserving more of the cornea's natural prolate shape (Figure 2A and B). Maintaining that shape provides a superior quality of vision.<sup>4</sup>

The laser's speed reduces the undesired variable drying effects on the cornea from exposure during the ablation, and that increased speed should yield more consistent results, especially in eyes that require high-diopter treatments. The ALLEGRETTO WAVE laser's rate of pulse delivery was 200 Hz during the FDA trials.<sup>1-3</sup> This rate was doubled to 400 Hz in June 2006, at which point it was designated the "Eye-Q". The laser's average ablation time is now 2 seconds per diopter of myopia, leading to average treatment times

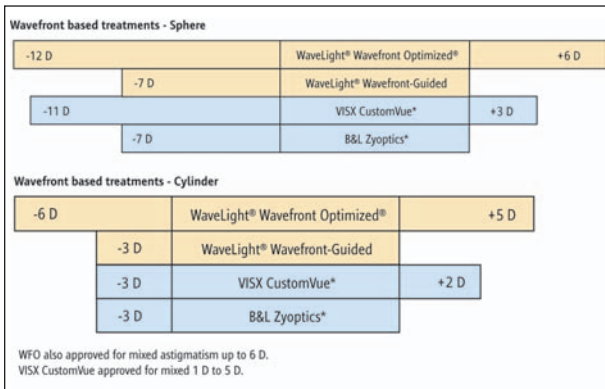


of about 12 seconds for 6.00 D of correction. As evidenced by our team's lower retreatment rates, it has greater accuracy than our previous lasers, especially on higher treatments. Furthermore, my colleagues and I appreciate that the wavefront-optimized treatment requires significantly less preoperative testing time and planning to set up than a wavefront-guided treatment, which requires technically demanding and time-consuming preoperative image capturing and registration.

The ALLEGRETTO WAVE Eye-Q's wavefront-optimized FDA-approved treatment range is -12.00 D of sphere and -6.00 D of astigmatism for myopia and +6.00 D of sphere and +5.00 D of astigmatism (up to spherical equivalent of +6.00) for hyperopia (Figure 3). It also provides mixed sphere/astigmatic treatments up to 6.00 D. Additionally, we can treat a wider range of patients with the ALLEGRETTO WAVE Eye-Q laser than we could with the Technolas, because the former removes less corneal tissue and uses a wider treatment area. The corrective algorithm minimizes tissue removal while it creates large optical zones. For example, in a recent patient using a 110- $\mu$ m IntraLase flap, the optical zone provided by the Technolas would have been 5.0 mm, versus 6.5 mm with the ALLEGRETTO WAVE. Thus, the ALLEGRETTO WAVE Eye-Q allows me to treat more patients and give them a better quality of vision than I could previously.

**LEARNING CURVE**

The ALLEGRETTO WAVE Eye-Q laser's software and ergonomics are more user friendly than those of the LADARVision4000 but less so than the Technolas 217's. However, any minimal inconvenience we experience operating the ALLEGRETTO WAVE is worth it, because it performs so much better and more reliably than the other systems.



**Figure 3.** These charts show wavefront-based treatments for sphere and cylinder for three excimer laser platforms. (Data derived from: U.S. Food and Drug Administration. WaveLight ALLEGRETTO WAVE™ Excimer Laser System. <http://www.fda.gov/cdrh/pdf3/p030008s004.html>. Approved April 19, 2006. Accessed March 12, 2009.)

“Once we began using the ALLEGRETTO WAVE Eye-Q, we could see that it was a superior product that delivered superior results. It performed better, our patients were happier, and the quality of their postoperative vision was better.”

Each of our surgeons is perfecting his own technique with the laser, but we are all very pleased with its performance. I have adopted a technique of using a larger, solid, stainless steel speculum designed for injecting the drug Lucentis (Genentech, Inc., South San Francisco, CA; for wet age-related macular degeneration), because it keeps the eyelashes and lid margins out of the way well enough that we no longer need to drape. After prepping the patient, we make sure the instruments do not touch anything other than the sterile eye. This approach provides a more thoroughly sterile field and saves us substantial time compared to what we used to spend applying either full or mini-drapes.

**BOOSTING THE BOTTOM LINE**

The ALLEGRETTO WAVE Eye-Q laser justifies our investment by providing a better quality of laser ablation at a faster speed and with more reliable outcomes. Previously, we could treat three patients per hour performing IntraLASIK with our other lasers. Now, we can provide IntraLASIK with the ALLEGRETTO WAVE Eye-Q laser to four patients per hour. That increased throughput and the lack of preoperative wavefront analysis has significantly improved our bottom line.

In terms of marketing the ALLEGRETTO WAVE Eye-Q to prospective patients, we educate them about the wavefront-optimized rationale and its results. The laser's 2006 FDA 3-month results were truly stunning. The following numbers compare the wavefront-optimized versus wavefront-guided cases: UCVA 20/12.5 = 22% versus 25%, UCVA 20/16 = 76% versus 64%, and UCVA 20/20 = 93% for both groups. Neither group experienced a mean worsening of contrast sensitivity, and patients' reports of glare from bright lights and while driving at night actually decreased after LASIK with both methods. Importantly, no patient required retreatment.<sup>3</sup> My colleagues and I share this information with our patients and also ask them to visit the ALLEGRETTO WAVE Eye-Q's Web site. We also stress our low rate of retreatment, because patients place a higher value on surgeries that do not need to be repeated.

*(Continued on page 14)*



# Optimized Surgery

How the ALLEGRETTO WAVE Eye-Q excimer laser's efficient wavefront-optimized technology translates into consistently impressive results.

BY GARY R. TYLOCK, MD

I am always seeking the best technology for my patients. About 9 months ago, I was interested in trying the ALLEGRETTO WAVE Eye-Q 400-Hz excimer laser (Alcon Laboratories, Inc., Fort Worth, TX) for a number of reasons, not the least of which was that several surgeons I talked with had raved about it. I was most intrigued by this laser's ability to accurately correct preoperative refractions without inducing higher-order aberrations. Previously, I was using the VISX STAR S4 IR laser (Abbott Medical Optics, Inc., Santa Ana, CA) exclusively, with predominantly wavefront-guided treatments. After a trial period, I bought the ALLEGRETTO WAVE Eye-Q laser, and this article describes my experience thus far.

## IMPRESSIVE FROM THE START

My observation is that the ALLEGRETTO WAVE Eye-Q laser is inherently able to sculpt corneal tissue more effectively, efficiently, and accurately than the VISX STAR S4 IR. The small-spot 0.95-mm Gaussian beam, working at 400 pulses per second, enables the ALLEGRETTO WAVE to reshape corneal tissue in a superior manner. This laser especially excels at hyperopic treatments where the cornea is steepened. Sculpting a steeper cornea is a much more difficult task than the central flattening employed in treating myopia. The VISX STAR

“My observation is that the ALLEGRETTO WAVE Eye-Q laser is inherently able to sculpt corneal tissue more effectively, efficiently, and accurately than the VISX STAR S4 IR.”

S4 IR uses a homogenous, variable-rate (6- to 20-Hz) laser with a variable spot size (0.65 to 6.5 mm) and is less adept at sculpting a steep cornea in hyperopic procedures. Also, the ALLEGRETTO WAVE Eye-Q laser's treatment times are much shorter compared with the VISX STAR S4 IR's, most dramatically for hyperopic treatments. The ALLEGRETTO WAVE takes 5 seconds per diopter to correct hyperopia with a 6.5-mm optical zone and a 9.0-mm ablation area. It takes only 2.5 seconds per diopter to correct myopia with a 6.5-mm optical zone. The STAR S4's treatment times are consistently longer, and certain hyperopic treatments can take over 2 minutes. A shorter treatment time helps to decrease patient anxiety and improves throughput, and more importantly, it improves patient outcomes by minimizing corneal drying.

## CONSISTENT EXPOSURE AND TREATMENT TIMES

I find both lasers to be very good overall at achieving myopic surgical targets. However, the ALLEGRETTO WAVE Eye-Q laser has shorter, more consistent exposure and treatment times because of its speed (400 Hz) and simplicity. Most of my treatment times are less than 12 seconds. The STAR S4's iris registration process can have a concerning time variable; it can operate quickly,



Figure 1. The patient's view of the ALLEGRETTO WAVE Eye-Q's fixation light.



## COMPARISON OF SOME OF THE FEATURES OF THE ALLEGRETTO WAVE EYE-Q AND THE VISX S4 LASERS

Type of Ablation	ALLEGRETTO WAVE Eye-Q Wavefront Optimized (maintains asphericity)	AMO VISX STAR S4 IR Wavefront Guided (aberrometer-driven)
Spot size	0.95 mm	variable 0.65 to 6.5 mm
Type of beam	Gaussian	Homogenous
Rate of treatment	400 Hz	6 to 20 Hz
Myopia w/o astigmatism optical zone/ablation zone	6.5-mm OZ 7.2-mm AZ	6.0-mm OZ 8.0-mm AZ
Myopia w/ astigmatism optical zone/ablation zone	6.5-mm OZ 7.2- x 9.0-mm AZ	6.0-mm OZ 8.0-mm AZ
Hyperopia w/o astigmatism optical zone/ablation zone	6.5-mm OZ 9.0-mm AZ	6.0-mm OZ 9.0-mm AZ
Hyperopia w/ astigmatism	6.5-mm OZ 9.0-mm AZ	6.0-mm OZ 9.0-mm AZ

slowly, or not at all. The STAR S4 IR must import and then process the iris' image, and then it will either give you the green light, or it might tell you that you need to capture and process another picture. During this time, the patient's cornea is drying out, and the outcome may be influenced by this dehydration. This additional unpredictable dehydration time variable added to some procedures makes it more difficult to establish a reliable nomogram.

The ALLEGRETTO WAVE Eye-Q laser has a very simple approach to preventing eye cyclorotation. It uses four amber lights that form a rectangle around the green flashing fixation beam (Figure 1). These four lights orient the patient's eye vertically and horizontally, eliminating or minimizing cyclorotation. Treating off-axis with the ALLEGRETTO WAVE has not been an issue.

### PREFERRED LASER IN SURGERY

I still use the STAR S4, but my preference has really grown for the ALLEGRETTO WAVE Eye-Q laser due to its performance. My practice focuses on LASIK and presbyopia-correcting IOLs, and I am pleased to have both lasers to use as needed. I use the ALLEGRETTO WAVE Eye-Q laser for approximately 95% of my surgeries, including all of my hyperopic treatments. I find its larger ablation zones especially helpful with patients who have large pupils. I tend to use the STAR S4 IR's

wavefront-guided treatments for eyes with corneal topographic irregularity and for unhappy LASIK patients who had 20/20 or 20/25 outcomes but also have a greater degree of higher-order RMS and require an enhancement.

### NOMOGRAMS AND OUTCOMES

I began using the ALLEGRETTO WAVE laser with the Wellington nomogram. A few months later, I started using DataLink, the online data tracking and nomogram software designed specifically for the ALLEGRETTO WAVE (<http://svc.surgivision.net/home/SVChome.html>), and it has been a huge asset in refining my outcomes and future treatments. Now that I have established my own ALLEGRETTO WAVE nomogram, my enhancement rates are measurably lower than they are with the STAR S4 laser. The most significant change has been with my hyperopic Intra-LASIK treatments, which have been excellent with the ALLEGRETTO WAVE laser.

### SELLING POINTS FOR PATIENTS

Most patients do not ask about the difference between wavefront-guided and wavefront-optimized treatments, but they are concerned about halos at night and other symptoms after undergoing LASIK. Because I am the official eye care provider and LASIK

*(Continued on page 14)*

# Separating Truth From Hype

Rely on data and unbiased recommendations when choosing a laser technology.

BY ROY S. RUBINFELD, MD

No surgeon is totally unbiased about a particular technology, but I may come fairly close to that ideal when it comes to the subject of excimer laser systems. I have been involved with excimer laser treatments since 1991. I have used nine different excimer systems, consulted for many ophthalmic companies and laser manufacturers, and I underwent laser vision correction myself in 1995.

I was a user and advocate of the VISX STAR S4 CustomVue laser platform (Abbott Medical Optics, Inc., Santa Ana, CA) for a long time until the ALLEGRETTO WAVE excimer laser (Alcon Laboratories, Inc., Fort Worth, TX) came along. Since the introduction of this platform in 2004, I have considered the ALLEGRETTO WAVE to be the best excimer laser currently available. Its wavefront-optimized technology has provided the best results, lowest enhancement rates, and fastest patient throughput of any excimer laser I have ever used. The ALLEGRETTO WAVE laser is my technology of choice for nearly all of my corneal refractive surgery patients, with the occasional exception of those who have substantial higher-order aberrations as a complication of prior laser surgery (which is a very small group of people).

## MISCONCEPTIONS

Despite the laser's advantages, some factors have limited the ALLEGRETTO WAVE's growth in market share among

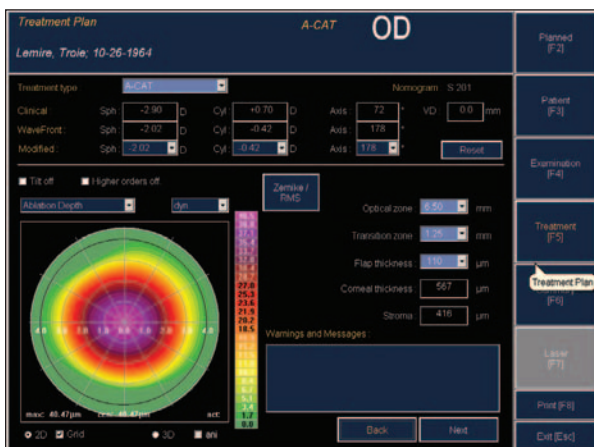


Figure 1. The ALLEGRETTO WAVE Eye-Q laser's screen shows the keratometric rendering of the eye.

“Marketing efforts have effectively convinced some surgeons that wavefront-guided technology is superior to wavefront-optimized technologies for most patients. This is simply untrue.”

surgeons. Some of these challenges are evident, such as the economic downturn. Another, subtler problem is that marketing efforts for the VISX laser platform have effectively convinced some surgeons that its wavefront-guided technology is superior to wavefront-optimized technology for most patients. This is simply untrue. Because the topic can be confusing, some surgeons have relied on the “expertise” of sales reps and engineers to increase their understanding of higher-order aberrations and wavefront-guided versus wavefront-optimized technologies. In simplified terms, both wavefront-guided and wavefront-optimized treatments are forms of customized laser vision correction, because they base their ablations on each individual eye. Wavefront-guided treatments are derived from aberrometry data, even though these readings can vary significantly with each blink. Wavefront-optimized treatments are derived from topographic or keratometric data (Figure 1).

Additionally, surgeons who use femtosecond lasers to cut LASIK flaps may not realize that these lasers can work more seamlessly with the ALLEGRETTO WAVE Eye-Q laser than with the VISX S4. When a femtosecond laser is positioned next to the ALLEGRETTO WAVE, the latter system's patient bed is designed to rotate between the two lasers so that the patient does not have to get up after his flap is created and move to the excimer laser for his ablation (Figure 2). This feature not only saves time and is more convenient for the patient, but it minimizes corneal drying and eliminates having to recapture the eye's centration.

## PERFORMANCE AND RELIABILITY

### Ease of Use

I find the ALLEGRETTO WAVE easier to use than any other platform in my experience. As someone who has





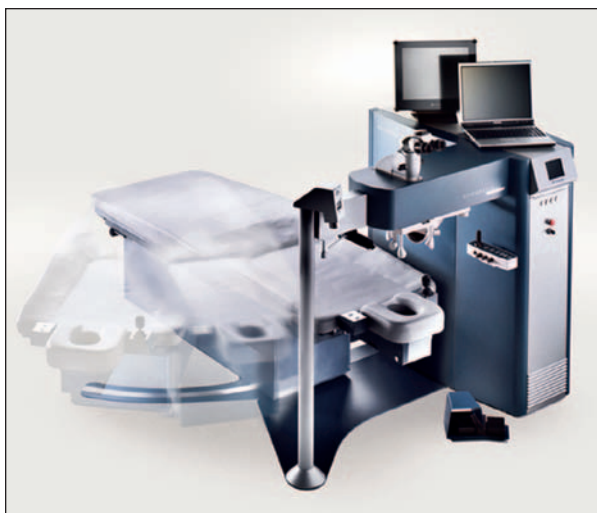
trained a good number of surgeons in the use of the ALLEGRETTO WAVE laser, I can state that most who have had experience with the VISX platform look up after first using the ALLEGRETTO WAVE and say something to the effect of, "That's it? It can't be that easy." This laser's efficiency and ease of use make it seem as though it leaves out some steps, but in fact, WaveScans, wavefront-adjusted manifest refractions, and other similar manipulations are truly unnecessary for nearly all patients in my experience and simply result in slow throughput of patients. The ALLEGRETTO WAVE requires no wavefront measurements, and its ablation times are short—my average ablation time is approximately 20 seconds per eye.

## Results

I was impressed with the ALLEGRETTO WAVE's superb refractive results right out of the box. Using the nomogram that Arthur Cummings, MD, developed,<sup>1</sup> my staff and I have been achieving consistently excellent results since 2004 with little or no modification. Having treated thousands of patients with this laser, from -13.00 to +5.50 D of sphere and up to 6.00 D of astigmatism, our enhancement rate is 4%. Our enhancement rate with the VISX CustomVue was 10% to 12%. Most practices depend heavily on word-of-mouth referrals, and lower enhancement rates provide a better patient experience and therefore more referrals. For many surgeons, this reason alone justifies the up-front expense of a new excimer laser.

## Registration and Tracking

The ALLEGRETTO WAVE laser's reliability is superior to any other technology I have ever used. In fact, I had for-



**Figure 2.** The ALLEGRETTO WAVE Eye-Q laser's patient bed is designed to swivel for positioning under a femtosecond laser.

"In over 4 years, I have never encountered a pupil that the ALLEGRETTO WAVE could not capture and track."

gotten how problematic pupil capture and tracking used to be with other systems until I recently used another laser with iris registration and had quite a difficult time capturing the pupil in order to treat the patient. I remember being unable to capture a significant percentage of irides with the STAR S4's iris registration system. In over 4 years, I have never encountered a pupil that the ALLEGRETTO WAVE could not capture and track. No pupil has yet been too big or too small for this laser.

## Treatment Optimization

Another major strength of the WaveLight family of lasers is that they are currently equipped with four different ways to customize laser treatments: wavefront-optimized, wavefront-guided, topography-guided, and asphericity or Q mode. International surgeons have used these applications with solid results. These technologies demonstrate that this platform's R&D is advanced and remarkable.

## SEE FOR YOURSELF

One of the most reliable sources of information for surgeons about the validity of new technologies is peer-to-peer communication. I have learned much about the ALLEGRETTO platform from trusted friends over the years, and I have been pleased to speak on behalf of this technology with many surgeons who have been considering shifting from another laser system to the ALLEGRETTO WAVE. When several of my colleagues (who are not "in bed" with any laser company) have similar opinions about a laser, I listen. I advise surgeons to test the ALLEGRETTO WAVE for themselves and see if what they have been hearing about this laser is true. ○

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1. Cummings A. The WaveLight ALLEGRETTO WAVE Experience. In: Probst LE, ed. *LASIK: Advances, Controversies, and Custom*. Thorofare, NJ: Slack Incorporated; 2004.

# Superior Performance and Outcomes

Switching from the VISX platform to the ALLEGRETTO WAVE Eye-Q excimer laser.

BY MICHAEL Y. WONG, MD

I first received the ALLEGRETTO WAVE Eye-Q excimer laser (Alcon Laboratories, Inc., Fort Worth, TX) in June 2008. I decided to try this laser after some discussions with colleagues led me to think that the ALLEGRETTO WAVE was a more reliable laser that would produce better results for my patients. Although I had 15 years of experience with the VISX STAR platform (Abbott Medical Optics, Inc., Santa Ana, CA) and obtained generally good results, certain aspects of it frustrated me.

## IMPETUS FOR CHANGE

On a practical level, with the STAR S4 laser, I had difficulty with the idea that I was making “physician adjustments” on the sphere, choosing from several wavescans that had different spherical corrections in an attempt to treat patients’ relatively minor higher-order aberrations. I felt that I was “missing the forest for the trees,” so to speak.

Operationally, the way the S4 laser managed its gas and energy levels was problematic. My staff and I seemed to be incessantly boosting, de-boosting, and cutting cards. Worst of all, the S4 laser shut down in the middle of several operations because the pressure of the gas in the laser chamber was too low. This was particularly troublesome with customized hyperopic treatments that required iris registration.

The VISX STAR S4 laser caused me a few problems surgically, as well. I disliked the long treatment times and felt that they caused variable corneal dehydration. I was less than confident in treating hyperopes with that laser. I also felt that the view and lighting through the STAR S4’s operating microscope left something to be desired—too often, I had to bring patients back to the OR to wash out debris from under their flaps.

Businesswise, the cost of the VISX custom card was higher than I liked.

For all these reasons, I surveyed all of the excimer laser platforms. I wanted a robust, reliable unit from a stable company that would continue to invest in research.

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“I feel I have more control over my treatments with [the ALLEGRETTO WAVE Eye-Q laser].”

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Over a period of 6 months, I spoke with numerous ophthalmologists who had no financial relationships with industry. Ultimately, I contacted Alcon Laboratories, Inc., about testing the ALLEGRETTO WAVE Eye-Q laser.

## PRACTICE EFFICIENCY

My partners and I have transitioned comfortably to the ALLEGRETTO WAVE Eye-Q laser and are very pleased with it in many ways. The physical setup and training took about 1 week. The ALLEGRETTO WAVE’s footprint is smaller than the STAR S4’s; I was able to pair it nicely with the IntraLase FS femtosecond laser (Abbott Medical Optics, Inc.) in the same room. There are some ergonomic differences and peculiarities to all platforms, but experienced surgeons will master the ALLEGRETTO WAVE’s easily.

My technical staff believes the setup and operation of the ALLEGRETTO WAVE system is easier than the STAR S4’s on a day-to-day basis. Starting up and calibrating the ALLEGRETTO WAVE in the morning and managing its gas and energy levels throughout the day are straightforward. The laser is calibrated by a micrometer, not by reading a treated card on a lensometer, like with the STAR S4.

Patient flow is another area in which the ALLEGRETTO WAVE laser shines. It requires none of the preoperative setup that some of the other lasers do—obtaining wavescans, choosing the best scan, making physician adjustments, designing the treatment, putting it on a “stick,” transferring the data to the laser, etc. The Eye-Q laser is simply less time consuming and has allowed me to consult with more patients and perform more surgeries each day.



## BETTER PERFORMANCE, PATIENT COMFORT

I have found that the ALLEGRETTO WAVE Eye-Q laser is easier to use preoperatively and intraoperatively than the STAR S4, and most importantly, my postoperative results seem to be better. Preoperatively, the VISX system requires some guesswork as to the “physician adjustment.” With the ALLEGRETTO WAVE system, the surgeon simply selects the patient’s best refraction and lets the program design an optimized treatment. I feel I have more control over my treatments with this laser.

Intraoperatively, the ALLEGRETTO WAVE Eye-Q laser offers a lot more comfort for patients than other lasers in several ways. First, its treatment times are magnificently rapid—in the neighborhood of 2 seconds per diopter for myopes and 3 seconds per diopter for hyperopes. This alacrity lessens patients’ time underneath the laser and reduces corneal drying. Also, the ALLEGRETTO WAVE laser has its own slit-lamp illumination, which allows me to check the flap’s position and look for debris under the flap without having to move the patient. Furthermore, the ALLEGRETTO WAVE laser integrates smoothly with the IntraLase laser. After flap creation with the IntraLase, with the touch of one button, the patient bed lowers itself, slides feet-ward out from under the IntraLase, swivels to the ALLEGRETTO WAVE, and slides back underneath the excimer laser’s head, ready for patient treatment.

## IMPROVED RESULTS

When I first adopted the ALLEGRETTO WAVE system, I used its wavefront-optimized pattern for primary treatments and the VISX CustomVue for retreatments, because I felt then that the latter treated higher-order aberrations better. Over time, I have discovered that the wavefront-optimized profile works wonderfully for

“Our patients’ postoperative satisfaction has never been higher, and our enhancement rate is approaching 2%.”

retreatments as well. This may be due to the large optical treatment zone.

Our patients’ postoperative satisfaction has never been higher, and our enhancement rate is approaching 2%. I attribute these great results primarily to the 400-Hz speed of the laser. Its Perfect Pulse technology (Alcon Laboratories, Inc.) (Figure 1) includes the speed of the laser and tracker, and I consider it the best tracking system available today. The video-based tracker reliably centers the excimer laser to the middle of the pupil, as opposed to basing centration on a less well-defined limbus. Furthermore, the ALLEGRETTO WAVE’s closed loop system is exquisitely precise. In special cases, I can make angle kappa or other adjustments to centration at my discretion.

The Eye-Q laser creates a truly wide ablation zone (I most commonly use 6.5 mm), and the prolate design makes nearly all of the ablated area a true refractive optical zone. For example, a 6.0-mm optical zone treatment on the ALLEGRETTO WAVE laser produces approximately the same postoperative topographical optical zone as a 6.5-mm treatment with a blended zone, or a 6.0-mm customized treatment on the STAR S4. This considered, the prolate design spares more corneal tissue than other ablation shapes. For instance, a -6.00 D myopic treatment performed with a 6-mm optical zone on the ALLEGRETTO WAVE laser ablates 83  $\mu\text{m}$  of tissue, whereas a 6.5-mm optical zone with a blended or customized treatment on the VISX consumes about 94  $\mu\text{m}$ . All of these components work together to reduce postoperative glare.

With the ALLEGRETTO WAVE Eye-Q laser, I am more comfortable treating certain refractive errors that I may have shied away from in the past with the VISX S4, because of the precise placement of the former’s 0.9-mm flying spots. For example, I have wonderful results with hyperopic treatments, which require many fine ablations in the periphery, as well as with astigmats, in which the major axis expands to 9 mm. The ALLEGRETTO WAVE’s

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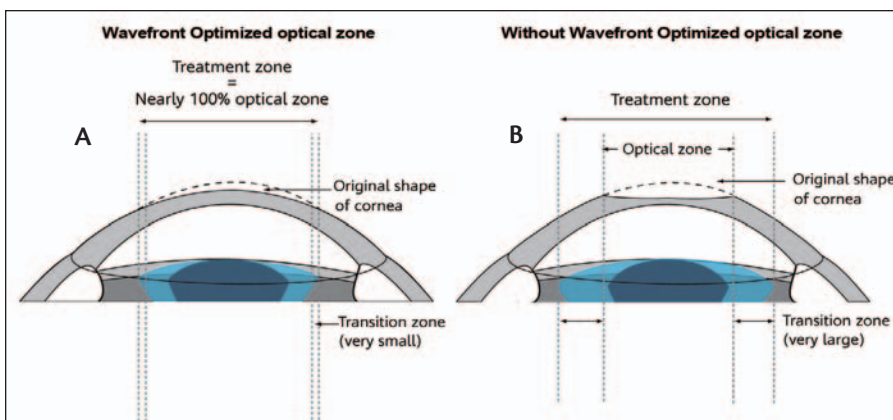


Figure 1. The WaveLight Perfect Pulse technology. Wavefront-optimized treatments result in a large true aspheric zone and a minimized transition zone (A). Treatments without wavefront-optimized lasers result in smaller optical zones and larger transition zones (B).



# Improving Outcomes With the ALLEGRETTO WAVE Eye-Q

How the laser's performance, coupled with DataLink tracking, has refined my results.

BY MARK E. WHITTEN, MD

I have been a longtime user of the VISX STAR S4 excimer laser (Abbott Medical Optics, Inc., Santa Ana, CA). I adopted the original ALLEGRETTO WAVE 200 laser years ago and used it occasionally. Recently, however, I upgraded to the ALLEGRETTO WAVE 400-Hz Eye-Q laser (Alcon Laboratories, Inc., Fort Worth, TX), which is a totally different system than its predecessor in terms of ease of use and outcomes. Since receiving our new system at one of our locations, I perform the majority of my cases there on the ALLEGRETTO WAVE 400 Eye-Q laser.

I still use the VISX STAR S4 laser at other locations, but there are certain patients for whom I prefer using the ALLEGRETTO WAVE Eye-Q laser. For example, I try to treat all of my hyperopic patients on the ALLEGRETTO WAVE, because it gives them better outcomes (Figures 1 and 2) and works faster. The only patients I do not treat on this laser are those with significant amounts of higher-order aberrations (an RMS value of 0.5+), for which I believe a wavefront-guided procedure is better. I currently do not have the analyzer from Alcon to perform this treatment on the Eye-Q.

## OUTCOMES TRACKING

One feature of the ALLEGRETTO WAVE Eye-Q laser that I particularly like is the DataLink program. This online, ALLEGRETTO-specific nomogram software allows me to enter every patient's outcome and constantly refines my nomogram. Although the software has been available for some time, I never tried it until I upgraded to the ALLEGRETTO WAVE Eye-Q 400 Hz. This tool has been invaluable in helping me move closer to my surgical targets and improve my outcomes. I no longer have surgical results worse than 20/40, and all my outcomes are within 0.50 D of my surgical plan. My weekly rate of 20/20 outcomes is in the 90th percentile.

I seldom need to retreat patients after performing surgery with the ALLEGRETTO WAVE. My enhancement rate with this laser is below 2%, compared with 3% with the STAR S4. Thus, the DataLink software has taught me a valuable lesson about taking the time to track my

patients' results and fine-tune my nomogram to get better results. Tracking my results helps improve my relationship with my referring optometrists, who enjoy the fact that their refractions are now key in patients' final results. They understand that their careful refractions are now vital for the outcomes of their patients, rather than relying on a wavefront analyzer to do the job.

## CLINICAL USE

The ALLEGRETTO WAVE offers many clinical advantages that help keep me relaxed and confident during surgery.

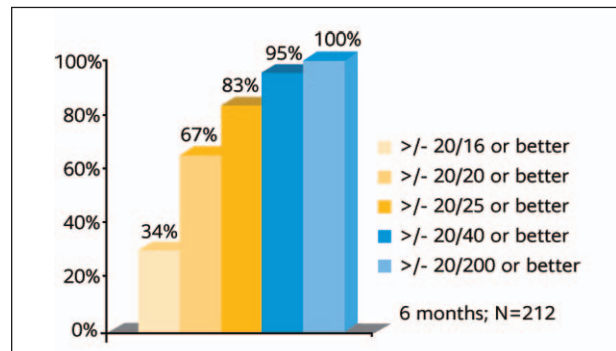


Figure 1. Hyperopic UCVA data from the ALLEGRETTO WAVE's 2003 FDA clinical trial (wavefront-optimized profile).<sup>1</sup>

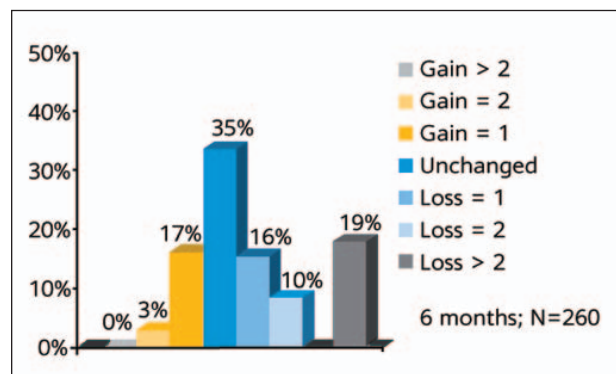


Figure 2. Data on the change in hyperopic post-UCVA versus pre-BSCVA from the ALLEGRETTO WAVE's 2003 FDA clinical trial (wavefront-optimized profile).<sup>1</sup>



For example, the ALLEGRETTO WAVE laser takes less time than the STAR S4 to complete an average myopic refractive correction, which improves patient comfort and throughput. Patient fixation is much easier under the ALLEGRETTO WAVE Eye-Q than with the VISX laser, too. I often have to hold my patients' heads still when using the STAR S4, because they are unable to focus on the red fixation light. I never need to do this with the ALLEGRETTO WAVE; patients are able to see its green flashing fixation light very easily. I also appreciate not having to acquire iris registration with the ALLEGRETTO WAVE laser. Registration is not always easy to achieve in the way Abbott Medical Optics, Inc., has suggested for the STAR S4, and my results are as good or better with the ALLEGRETTO WAVE Eye-Q laser.

**"I seldom need to retreat patients after performing surgery with the ALLEGRETTO WAVE. My enhancement rate with this laser is below 2%."**

I use the IntraLase FS femtosecond laser (Abbott Medical Optics, Inc.) to make my LASIK flaps. When I had the IntraLase positioned next to the ALLEGRETTO WAVE, I was able to use the ALLEGRETTO's movable bed between the two lasers, which was another convenience I appreciated.

## CLOSING THOUGHTS

My impression is that overall, patient results are surprisingly better with the ALLEGRETTO WAVE Eye-Q 400-Hz Eye-Q than they were with the 200-Hz laser. I suspect the reason is the laser's speed and accuracy in addition to the benefits derived from DataLink tracking. I am hopeful that because WaveLight is now a part of Alcon, the ALLEGRETTO WAVE will continue to improve. In short, it is a great instrument, and I enjoy using it. ○

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1. U.S. Food and Drug Administration. WaveLight ALLEGRETTO WAVE™ Excimer Laser System. Wavefront Optimized for Hyperopia. <http://www.fda.gov/cdrh/pdf3/P030008.html>. Issued October 10, 2003. Accessed March 12, 2009.

**"I have been able to market this laser's technology to draw more patients. Its faster and more accurate tracker and the speed of the treatment are very appealing to patients."**

*(Continued from page 11)*

aspheric treatment combined with cosine factor adjustments to account for parallax error (to deliver more energy in the periphery) for high myopes also achieves excellent results.

## A SMART ECONOMIC MOVE

The past year has been challenging economically for all refractive surgeons, but I believe my practice is better positioned to weather the downturn with the ALLEGRETTO WAVE Eye-Q laser than it was previously. I have been able to market this laser's technology to draw more patients. Its faster and more accurate tracker and the speed of the treatment are very appealing to patients. Simply put, happier patients who have great results and a more comfortable experience refer more friends, and lowering enhancement rates stimulates more growth. Furthermore, the ALLEGRETTO WAVE's treatment card fee is significantly less than the fee for the VISX Custom Card.

## CONCLUSIONS

Overall, my practice's experience with the ALLEGRETTO WAVE Eye-Q laser and its manufacturer has been very positive. This laser is extremely effective and efficient. I have used it successfully for PRK, which currently is an off-label use. The only shortcoming I have found is that it does not treat coma and other higher-order aberrations, but in practice, this has turned out to be a minor issue. Furthermore, my staff and I have been very pleased by the attention we have received from Alcon Laboratories, Inc. The company's technical and sales support is great, and I have no complaints whatsoever. I would highly recommend this laser. ○

*Michael Y. Wong, MD, is a refractive specialist at Wills Laser Vision in Princeton, New Jersey. He has no financial interest in any product or company mentioned herein but has received research support from Alcon Laboratories, Inc., in other areas of study. Dr. Wong may be reached at (609) 921-9437; mwong2020@hotmail.com.*



(Continued from page 5)

## TECHNICAL SUPPORT

When looking to buy a new product, surgeons want something that has performed well in its FDA trials and also in subsequent studies, and they want a product that has a reliable history and is supported by a reliable company. Alcon Laboratories, Inc., acquired WaveLight AG in September 2007, and that acquisition gave us even greater confidence in our commitment to the ALLEGRETTO excimer platform. The company is the industry leader for anterior and posterior segment eye surgical products, and I think this high-speed wavefront-optimized platform (also with optional wavefront-guided treatments) finally gives it technical superiority in an excimer laser. My colleagues and I have always had good relationships with Alcon's technical support and educational staff, and we expect to enjoy the same level of service with the ALLEGRETTO WAVE Eye-Q.

## GRADE "A" WORK

New medical technology will succeed regardless of price, as long as it meets three criteria: being safer, faster, and better than its predecessors. These are the parameters by which my colleagues and I evaluate all new technologies. Because the ALLEGRETTO WAVE Eye-Q laser met all these criteria, we knew we had to invest in it. This laser, with its wavefront-optimized platform, allows us to give our patients better results, and we will ultimately attract more patients for that reason. We want to go to our offices knowing that we are performing grade "A" work, and our previous system for providing LASIK had begun to feel like grade "B" work, especially after the wavefront-optimized profile became available. With the ALLEGRETTO WAVE Eye-Q laser, we truly feel as though we are offering our patients better surgery. ○

*James A. Davison, MD, FACS, specializes in cataract and refractive surgery at the Wolfe Eye Clinic, which is headquartered in Marshalltown, Iowa. He is a paid consultant to Alcon Surgical. Dr. Davison may be reached at (641) 754-6200 ext. 1025; jdavison@wolfeclinic.com.*



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surgeon for several major-league sports teams in the Dallas area, I cannot tolerate a high rate of postoperative symptoms or retreatments. I reassure my patients that the ALLEGRETTO WAVE's larger ablation zone and wavefront-optimized treatment minimize the risk of postsurgical symptoms and the need for enhancements tremendously. This laser is spherical-aberration neutral; it compensates for energy loss in the peripheral cornea with more laser pulses.

## SUPPORT EXPERIENCE

Alcon's support with helping my staff and me to get the ALLEGRETTO WAVE up and running was outstanding. Our trainer was excellent; she was very thorough and responsive to our needs and stayed with us through our first treatment days. In fact, she stayed until we felt comfortable enough operating the laser to tell her we no longer needed her.

## A REAL ASSET

I believe the ALLEGRETTO WAVE Eye-Q laser is a real asset to my practice, and I like having it. I may not be saving money by maintaining two lasers, but I do think I am offering my patients a more comprehensive service with more capabilities. Over the past 9 months, the ALLEGRETTO WAVE Eye-Q laser has required very little maintenance, and it seems to be solidly built and reliable. I have not had any problems with it thus far. My staff and I enjoy using this technology and look forward to continually refining our outcomes and increasing the value of our service to our patients. ○

*Gary R. Tylock, MD, is Director and Chief Surgeon at the Tylock Eye Care & Laser Center in Irving, Texas. He acknowledged no financial interest in any product or company mentioned herein. Dr. Tylock may be reached at (972) 258-6400; garyrt4@verizon.net.*





# What made *you* switch to the ALLEGRETTO WAVE Eye-Q laser?

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“The combination of FDA studies, post-FDA studies, and the testimonials of colleagues convinced us to make the commitment to adopt the ALLEGRETTO WAVE Eye-Q excimer laser.”

—James A. Davison, MD, FACS

“I have been involved with excimer laser treatments since 1991. I have used nine different excimer systems, consulted for many ophthalmic companies and laser manufacturers, and I underwent laser vision correction myself in 1995. Since the introduction of this platform in 2004, I have considered the ALLEGRETTO WAVE to be the best excimer laser currently available.”

—Roy S. Rubinfeld, MD

“I was interested in trying the ALLEGRETTO WAVE Eye-Q 400-Hz excimer laser for a number of reasons, not the least of which was that several surgeons I talked with had raved about it. I was most intrigued by this laser’s ability to accurately correct preoperative refractions without inducing higher-order aberrations.”

—Gary R. Tylock, MD

“I upgraded to the ALLEGRETTO WAVE 400-Hz Eye-Q laser, which is a totally different system than its predecessor in terms of ease of use and outcomes.”

—Mark E. Whitten, MD

“I decided to try this laser after some discussions with colleagues led me to think that the ALLEGRETTO WAVE was a more reliable laser that would produce better results for my patients. Over a period of 6 months, I spoke with numerous ophthalmologists who had no financial relationships with industry. Ultimately, I contacted Alcon Laboratories, Inc., about testing the ALLEGRETTO WAVE Eye-Q laser.”

—Michael Y. Wong, MD

