

The ALLEGRETTO WAVE Excimer Laser: The Next Generation in Technology

The necessity of wavefront-guided ablation depends on the laser.

BY RAYMOND STEIN, MD, FRCSC

AMONG THE NEXT GENERATION IN LASER SURGERY is a very exciting technology, the ALLEGRETTO WAVE Excimer Laser (WaveLight Laser Technologie AG, Erlangen, Germany). We have known for a long time that not all lasers are created equal. The ALLEGRETTO WAVE has a number of unique technological features that account for its outstanding clinical results. I would like to discuss some of the features that make the ALLEGRETTO WAVE unique and explain why the results of standard, prolate, or aspheric ablations with the Allegretto often surpass wavefront-guided outcomes with other laser systems.

OUR CHOICE OF LASER

I have been involved with laser vision correction over the past 12 years and have treated thousands of eyes. I have used and purchased multiple laser systems, including the NIDEK, Inc. (Freemont, CA), LaserSight Technologies, Inc. (Winter Park, FL), and all of the VISX, Inc. (Santa Clara, CA) lasers, including the 20/20 B and the current VISX S4. I began a trial with the ALLEGRETTO WAVE in June 2002, and 2 months later I paid full price for the laser. Now, 99% of the cases we perform at the Bochner Eye Institute in Toronto are with the ALLEGRETTO WAVE.

FEATURES OF THE ALLEGRETTO WAVE

The ALLEGRETTO WAVE laser has a compact design and requires only minimal maintenance. It is easy to calibrate, similar to a YAG laser, and features stable fluence during an entire day's work and from week to week. The laser system also has an excellent working distance to allow for the use of a microkeratome.

One of the features I like best about this laser is its outstanding optics, made possible by a slit-lamp attachment that allows the surgeon to visualize striae, if present, as well as any debris underneath the flap. Additionally, for enhancement procedures, the slit-lamp attachment makes it easy to visualize the flap's edge.

The ALLEGRETTO WAVE has a very fast treatment speed, firing at 200 Hz. We can therefore treat 1.00 D every 4 seconds with a 6-mm optical zone. This speed allows for

very short treatment times. It operates three times as fast as a laser with a similar spot size at 60 Hz. With regard to treatment times per diopter, WaveLight's laser is the fastest on the market today. A rapid treatment speed translates into less dehydration of the corneal bed, which then results in improved refractive predictability and fewer hydration changes of the flap. These components reduce the incidence of striae.

With a 0.95-mm spot size, the ALLEGRETTO WAVE can perform wavefront-guided ablations if required. It also features a Gaussian beam that produces a smoother stromal surface compared with a flat-top beam.

The ALLEGRETTO WAVE's unique eye-tracking system is extremely simple to use. It has no buttons to press, and the tracker automatically locks onto the pupil. In 2,300 consecu-

TABLE 1. STANDARD AND CUSTOMIZED PROPERTIES OF THREE LASERS

STANDARD ABLATION	CUSTOMIZED ABLATION
VISX S4	
Broad-beam	Variable-spot scanning
Each pulse centered over pupil	Change in shot-pattern delivery
Prophylactic central island treatment	No central-island treatment
Pure astigmatism, short meridian 5.0 mm	Larger optical zones Wavefront-guided
Bausch & Lomb Technolas	
2-mm flying spot	1- and 2-mm flying spot
Flat-top beam	Truncated Gaussian beam
Smaller optical zones	Larger optical zones Wavefront-guided
ALLEGRETTO WAVE	
Flying spot	Flying spot
Gaussian beam	Gaussian beam
200 Hz speed	200 Hz speed
200 Hz tracker	200 Hz tracker
Prolate ablation	Prolate ablation Wavefront-guided

tive eyes, we have not had one instance in which it would not track the eye. I have had a few cases of rapid jerk nystagmus that were well tracked with a satisfactory outcome. The system tracks small (1.8 mm) to large (8.0 mm) pupils, it reacts to the size of the pupil, and requires no dilation.

CUSTOMIZED PROLATE ABLATION

The normal curvature of a healthy cornea is prolate. Most laser systems, however, create an oblate cornea, which is flatter centrally and steeper in the periphery. This oblate shape causes spherical aberration, which degrades the quality of vision, especially at night, and often produces glare or halos. The ALLEGRETTO WAVE uses proprietary nomograms to adjust the asphericity of the cornea to perform a prolate ablation based on the anterior curvature readings. This prolate curvature accounts for the excellent quality of vision during the day and night.

CUSTOMIZED ABLATION VERSUS STANDARD

Although customized corneal ablation has been the buzzword in refractive surgery over the past year, a number of myths exist regarding this technology. First, correcting preoperative higher-order aberrations is not critical to achieving excellent quality of vision. For routine primary cases, an ablation that induces a minimal increase or decrease in the amount of higher-order aberrations is most important. Most wavefront-guided laser systems show an improvement compared with conventional treatments, but the technologies tend to increase the amount of higher-order aberrations from baseline. Second, you do not need a wavefront-guided ablation to decrease higher-order aberrations. You can reduce their number by using a better laser beam, larger optical and transition zones, and improved postoperative corneal curvature. Maintaining a prolate corneal curvature can dramatically affect spherical aberration.

To determine whether the reported improved outcomes with customized ablations are primarily related to wavefront-guided treatments, we should consider the VISX S4 laser system and compare its standard ablation with its customized ablation (Table 1). In standard ablation, it uses a broad-beam laser, performs a prophylactic central-island treatment, and has a maximum optical zone size of 6.5 mm. With a pure astigmatism case (eg, plano -2.00 X 90), the short meridian is only 5 mm. However, with a customized ablation, the system uses variable-spot scanning; there is a change in shot-pattern delivery, and hence no prophylactic island treatment is required; the optical zones are enlarged; and wavefront-guided ablations have been added.

Although the VISX S4 results are superior with "wavefront treatments" compared with the standard S4 ablation, I believe that in the majority of primary cases that have a low incidence of preoperative higher-order aberrations, this

improvement is related not to wavefront technology, but to the other changes made to the laser. These changes are included in the ALLEGRETTO WAVE's standard treatment.

A standard ablation with the Technolas laser (Bausch & Lomb Surgical, Inc., San Dimas, CA) (Table 1) uses a 2-mm flying spot, flat-top beam. Its customized Zyoptix ablation uses both a 1- and 2-mm flying spot, a truncated Gaussian beam, enlarged optical zones, and added wavefront technology. It is unclear whether the superior results with Zyoptix are related to wavefront factors.

The only difference between the ALLEGRETTO WAVE's standard and customized ablations (Table 1) is the addition of a wavefront-guided treatment. At the Bochner Eye Institute, the results for myopia and astigmatism (-1.00 to -10.00 D) in 2,300 consecutive eyes using standard ablation with the ALLEGRETTO WAVE showed that 60% of eyes achieved 20/15 UCVA, and that 91% were 20/20 or better. Breaking down this large group to -6.00 D or less of myopia and -3.00 D or less of astigmatism showed that 98% were 20/20 or better. These standard ablation results with the ALLEGRETTO WAVE can compete with or surpass any wavefront-driven system on the market today.

CURRENT INDICATIONS

My current clinical indications for wavefront-guided ablation using the ALLEGRETTO WAVE include patients with a high amount of higher-order aberrations and/or high RMS value, most of whom are secondary cases (previous oblate ablations and other types of refractive surgery), and patients with a loss of BCVA from irregular astigmatism, most of whom have forme fruste keratoconus or keratoconus for which we perform customized surface ablation. In my own clinical practice, I treat 96% of the patients with a standard prolate ablation using the ALLEGRETTO WAVE, and for 4% I use a wavefront-guided ablation.

Surgeons will hear much more about this technology as it nears approval in the US. In Canada, where all laser technology (wavefront and nonwavefront) is readily available, the ALLEGRETTO WAVE's prolate ablation allows us to compete in a mature laser market. The laser is easy to use, is reliable, enables extremely rapid treatment, and allows us to customize the optical zones. It also features tissue-saving nomograms that decrease the ablation depth and produces an aspheric ablation that provides excellent quality of vision. ☆

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