

Navigated Retinal Photocoagulation

The Navilas integrates key components of the diagnostic and therapeutic process.

BY MICHAEL D. OBER, MD

Being a retinal specialist entails mastering a multitude of techniques and ever-emerging technologies to ensure that patients receive the best possible care. This process begins during residency, when operating foreign equipment such as the slit lamp and indirect ophthalmoscope become second nature. In our typical workweek, we utilize dozens of technologies to diagnose, manage, and treat our patients. From contact lens examination, scleral depression, and intravitreal injection, to fluorescein angiography, the operative microscope, and wide-angle viewing systems, we cruise seamlessly from one apparatus to another without hesitation or second thought. When new technology arrives, many of us quickly adopt those that improve patient care, efficiency, or outcomes. For example, wide-field viewing in the OR required new skills and the ability to interact with a different environment, but the obvious benefits led to near universal adoption. The recent integration of optical coherence tomography (OCT) into our everyday lives shows how quickly we can integrate pieces of information that were once unfamiliar.

The recent introduction of the Navilas laser (OD-OS GmbH, Teltow, Germany) represents another technological leap forward in the care of retina patients. It optimizes performance by integrating key components of the diagnostic and therapeutic process in a unique, intuitive approach that has never before been available. In this article, I discuss how the ability to register and overlay a diagnostic fluorescein angiographic or fundus image in real time to a live fundus view opens a new paradigm in retina laser photocoagulation.

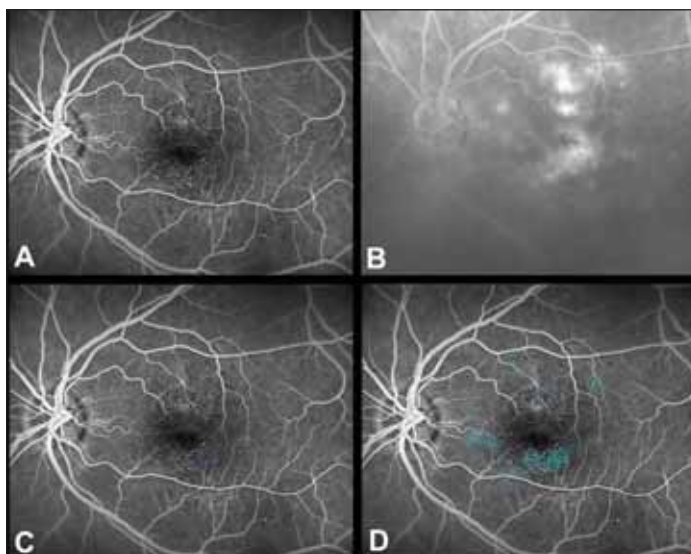


Figure 1. Mid-phase fluorescein angiography image of a patient with diabetic macular edema showing multiple microaneurysms (A). Late phase FA showing leakage in macula (B). Treatment plan created in NAVILAS showing proposed 50 µm laser spots circled in dark blue (C). Post-treatment representation showing the location where the laser actually fired during treatment represented on the same early phase pre-treatment fluorescein angiography image. Note that there are several clusters of circles in close proximity representing multiple firings on the same location (D).

WHAT IS NAVIGATED PHOTOCOAGULATION?

Navilas is a diagnostic and interventional device that integrates imaging technology with 532-nm laser photocoagulation. Although this is a unique combination in and of itself, it is only the beginning. The system can acquire mydriatic, and nonmydriatic color and infrared photos as well as fluorescein angiographic images that are equal or superior to existing systems.¹ With a novel

patented light source and image sensor, the Navilas is the only device that provides continuous imaging in all modalities. With 25 frames acquired per second, quality is greatly improved via image averaging.

Once images are acquired, they can be reviewed by the treating physician during the planning stage. This is similar to the process with any standard digital imaging system, except that the Navilas allows the user to make notations on a selected fluorescein (or color/infrared if desired) image using a touchscreen or mouse. These notations represent the exact location for laser application (Figures 1-4). Because notations are made on the fluorescein image, individual microaneurysms are easily targeted, as well as areas of leakage and capillary dropout. Many options are available, such as individual spots (sized from 50 μm to 500 μm) or a multitude of patterns (Figure 5), all of which can be individually tailored to the pathology.

When the treatment is being applied, the real benefits emerge. A live fundus image appears on the integrated touchscreen. Once the pre-planned fluorescein image is registered to the live fundus image, it appears aligned and overlaid in realtime to the live fundus view. The user then turns off the fluorescein image, leaving the live fundus view with small circles marking the spots preplanned for laser application. In this way, one can see the location of the areas to treat moving with the live fundus view. In practice, I prefer to use infrared background illumination at this stage because it is more comfortable for the patient, although color viewing is also possible. The Navilas then moves the aiming beam to the first preplanned treatment spot. Laser is applied with a footpedal, which can adjust power with right or left clicks. During laser delivery, the Navilas system's proprietary navigation system continuously registers the laser to the fundus and follows eye movement to ensure that the laser spots are delivered to the intended site. Preliminary testing shows the registration and laser delivery to be highly accurate.² After laser application, color photos can be taken and studied to assess the degree of laser burn. Once satisfied, the treating physician then moves to the next treatment spot. It is possible to move quite quickly from one spot to the next and even complete an entire pattern without lifting off the foot-pedal if desired. Standard adjustments to the laser application

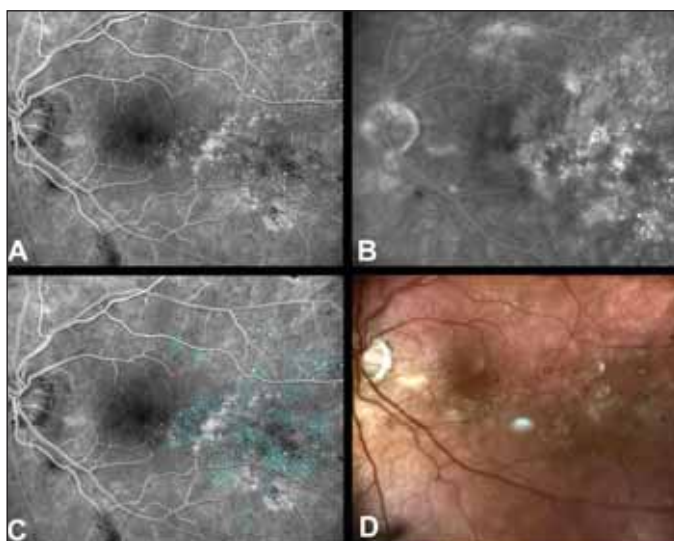


Figure 2. Early phase FA image of a patient with IRVAN and telangiectasia with macular edema (A). Late phase FA showing macular edema and leaking microaneurysms (B). Post-treatment representation showing the location of laser firing during treatment (C). Post-treatment color image showing laser uptake in the tissue (D).

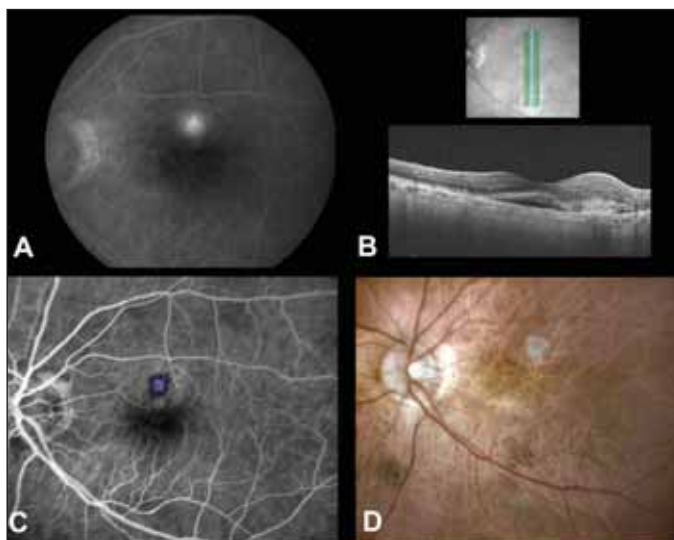


Figure 3. Late phase FA image (not taken on Navilas) showing leakage from extrafoveal CNV in a patient with AMD (A). Vertical OCT image showing subretinal fluid and intraretinal edema (B). Early phase Navilas FA image on same patient following three intravitreal injections of bevacizumab (Avastin, Genentech) with superimposed planned laser treatment spots (overlapping blue circles) in MPS like fashion (C). Color image immediately following laser application (D).

are available, such as spot size, duration, and power.

At the completion of treatment, another unique feature emerges: a photographic representation of each laser application marked with a circle along with printed documentation of all laser parameters. All aspects of the

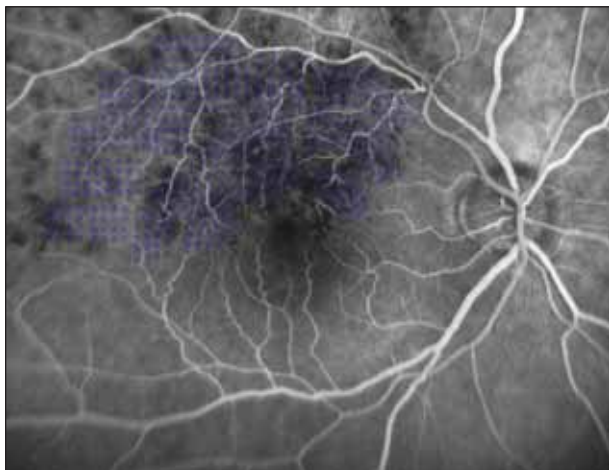


Figure 4. Blue circles represent treatment plan created for a patient with macular edema secondary to BRVO.

process are digitally documented, from imaging to planning to treatment. This information is easily adapted to electronic medical records or printed for the chart. No other laser system offers this type of documentation. In this way, even subthreshold treatments are well documented and can be used to plan subsequent treatments.

THE LEARNING CURVE

Most of us remember our first experience with a conventional laser. Those still involved in teaching this skill to young residents can further attest to the challenge this new skill poses. The transition to Navilas-based laser is far easier. By bypassing the slit lamp, users gain the benefit of a full 50° upright view of the fundus at all times. There is no difficulty recognizing landmarks such as the disc, fovea, or major vessels because they are all visible at once throughout the treatment process. There is no loss of orientation due to inverted images. Furthermore, conventional laser often entails constant consultation with a nearby fluorescein image projected from film or digitally displayed. The treating physician's attention must alternate back and forth, making comparisons from landmarks in the fluorescein angiography image to those in the small slit view in order to locate the exact position in the retina. With direct overlay of the fluorescein image registered in real time to the live 50° fundus view, there is no need to make any comparison or shift attention.^{3,4}

Navilas functions differently from any other system. Therefore it requires becoming accustomed to a novel and unique interface, but its learning curve is quite shallow. The touchscreen interface is intuitive and does not demand complex programming. Many functions have never before been available, such as planning, fluores-

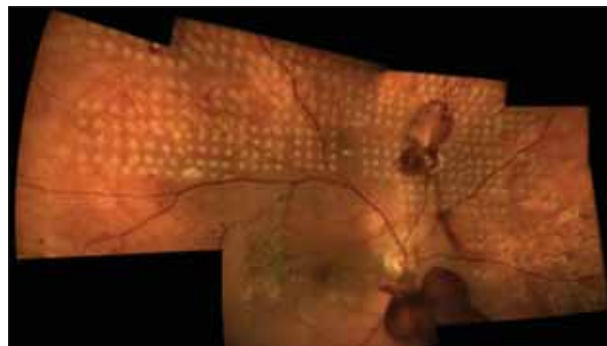


Figure 5. Immediate post-treatment montage color image (photos taken by Navilas, montage created by AutoMontage [Ophthalmic Imaging Systems, Sacramento, CA]) of a patient with proliferative diabetic retinopathy treated with panretinal photocoagulation using the pattern laser feature of Navilas. No preplanning or tracking features were used.

cein overlay, and navigation, and each of these can be independently controlled through shortcut buttons on the joystick or via the touchscreen interface. Once the user becomes familiar with the system, the multifunction joystick becomes second nature, and treatments become a rapid, instinctive process. In many ways, the device itself maneuvers similar to a fundus camera. The navigation system enables more accurate delivery of the laser treatment to the planned site without having to worry about manually compensating for physician, patient, or eye movement and therefore eases the learning process considerably. Early experiences demonstrated rapid improvement in proficiency following repeated use of the Navilas system; with more familiarity, speeds will undoubtedly increase further.^{3,4}

EDUCATION

The Navilas is particularly valuable for the education of residents and fellows. The system allows preceptors and students to review fluorescein image studies and create a treatment plan together, which represents a blueprint for proposed laser treatment. Navilas then allows the young physician to carry out this treatment plan exactly as drawn during the planning stage. Supervision during conventional slit-lamp based laser leaves a lot to be desired. The assistant-side scope provides a monocular view, which often does not represent the full image used by the operating physician. Navilas eliminates the guesswork. Both the preceptor and trainee view the live treatment on the same wide-view screen, which provides an upright 50° image throughout. Furthermore, notations can be placed on the treatment plan to signify caution zones where laser burns should be avoided such as an enlarged foveal avascular zone.⁵

ERGONOMICS

One of the common causes for disability among retina physicians is back pain. A survey of almost 700 ophthalmologists revealed that 52% of respondents complained of back pain symptoms and 15% were slightly to moderately limited at work because of back pain.⁶ The slit lamp can be considered a significant contributing factor, especially when the operator is using a handheld contact lens. The Navilas frees the user from the fixed neck position necessary for slit-lamp-based treatments. A comfortable position is easily achieved during treatments because all viewing takes place on the adjustable touchscreen. Patient comfort is also easier to achieve as physician positioning is no longer as great a concern.

CONCLUSION

The Navilas is currently the only system that incorporates imaging, planning, and treatment in a single retinal laser device. In my opinion, it enriches resident and fellow education and increases the accuracy of laser applications. The system improves ergonomic comfort for treating physicians and patients. Furthermore, easy and highly accurate treatment documentation not only satisfies the most stringent com-

pliance necessities, it also facilitates planning of subsequent laser treatments, especially where subthreshold application renders scars invisible. With all these advantages, the Navilas has the potential to revolutionize our management of many retinal disorders. ■

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