Multispot Laser Photocoagulation

This laser technology is well tolerated by patients, produces fewer side effects, and is safer than conventional laser photocoagulation.

BY SEBASTIEN GUIGOU, MD

LASER PHOTOCOAGULATION IS A PROVEN TREATMENT FOR RETINAL PATHOLOGIES AND HAS BEEN USED FOR MORE THAN 60 YEARS TO TREAT A VARIETY OF DIABETIC RETINOPATHIES, MICROANEURYSMS, AND MACULAR EDEMAS. BEFORE THE ADVENT OF MULTISPOt LASER SYSTEMS, PHOTOCOAGULATION PROTOCOL REQUIRED SURGEONS TO ADMINISTER A SERIES OF SINGLE-SPOT LASER BURNS.¹ WHEN USED FOR GRID THERAPIES OR PANRETINAL PHOTOCOAGULATION (PRP), WHICH REQUIRE THE DELIVERY OF MULTIPLE SPOTS, CONVENTIONAL LASER TREATMENT IS TIME-CONSUMING AND TIRING FOR BOTH PATIENT AND SURGEON. FURTHERMORE, SINGLE-SPOT TREATMENT IS ASSOCIATED WITH SEVERAL SIDE EFFECTS (SUCH AS RETINAL EDEMA AND VISUAL FIELD DEFECTS) AND CAN BE PAINFUL FOR PATIENTS. THE ADVENT OF MULTISPOt LASERS, SUCH AS THE VITRA MULTISPOt (532 NM GREEN Nd:YAG, QUANTEL MEDICAL) OR THE SUPRA SCAN 577 (577 NM YELLOW MULTISPOt OR MICROPULSE, QUANTEL MEDICAL), HAS CHANGED THE FACE OF LASER PHOTOCOAGULATION, MAKING IT SAFER, EASIER, AND MORE EFFECTIVE.

PERSONAL EXPERIENCE

I have experience with both multispot lasers referenced above. These are both manufactured as complete and compact consoles that can be adapted to a slit lamp and can be operated in a hands-free manner using a foot pedal to deliver the laser.

Both lasers also offer a large choice of spot patterns that can be adapted to the type and location of the lesion being treated (ie, either macular lesion or peripheral lesion). Personal experience and literature reports show that multispot treatment is safer and easier to perform than conventional laser treatment.¹² A significant advantage to using these lasers is that they reduce the time required for treatment, both by decreasing the number of required sessions and by decreasing the length of each session.¹² Furthermore, they cause fewer complications for patients.¹² In terms of duration, multispot treatments take about a third of the time required for conventional laser treatment, produce less scarring, reduce the occurrence of secondary macular edema, and increase retinal sensitivity as compared with conventional laser.²

I have found that multispot laser treatment is as effective as conventional laser therapy in treating retinopathy, diabetic neovascularization, and diabetic macular edema (DME).⁵

THE ROAD FROM CONVENTIONAL TO MULTISPOt LASER

The efficacy of multispot lasers can be attributed to several changes that have been made in the treatment parameters for multispot lasers as compared with treatment parameters for conventional lasers. The exposure time to the laser has been reduced and the laser’s power increased. The duration of laser treatment has been reduced from 100 ms to 10 ms to 20 ms. Once the laser duration is defined, the power of the laser can then be titrated from 200 mW to higher than 600 mW. Decreased duration of exposure and increased laser power result in better localization of the laser to the external retina and a reduction in thermal diffusion, which reduces the amount of epithelial scarring, scotoma, and inflammation associated with laser.¹²⁶ Multispot laser is also less painful for the patient, as thermal diffusion in the choroid, where pain receptors reside, has been reduced.¹

Multispot laser allows spots to be delivered almost simultaneously and with greater regularity than conven-
tional treatment. The spots are delivered in a 3 x 3 or 4 x 4 matrix, allowing more spots to be delivered in a shorter period of time, thus reducing the total time of treatment.

These changes, however, have introduced a new step that surgeons must consider during laser treatment, the determination of threshold power. Because the threshold power depends on the duration of the burns and the location and type of lesion in question, the surgeon must titrate the power during the delivery of the first few spots to achieve the desired effect.

**CONVENTIONAL vs MULTISpot TREATMENT**

The difference between the effects of conventional and multispot treatment can best be visualized by optical coherence tomography (OCT). With conventional laser treatment, the spots are irregularly spaced and there is a cavitation of the external nuclear layer affecting both the internal and external retinal layers. Multispot laser treatment creates spots that are regular in size and spacing and are localized to the external retina (Figure 1).

These effects are seen even in the long term (Figure 2). One month after treatment, areas with multispot treatment show an effect localized to the external retina and well-preserved nuclear and sensory receptor layers. With conventional treatment, there is greater retinal atrophy with several pigment epithelial windows. Additionally, the sizes of spots 1 month after conventional laser treatment are similar to those on the day of treatment, whereas the sizes of spots decreased over time after multispot laser treatment.

**MULTISpot LASER IN PRACTICE**

Although the general protocol for multispot treatment is similar for peripheral and macular photocoagulation, the parameters of treatment are different (Table 1).

In both peripheral and macular treatment, the first step is to fix the spot diameter. For peripheral treatment, this is usually fixed at 400 µm (200 µm x 2 corresponding to lens magnification factor). For macular lesions and focal macular edema, this is fixed at 100 µm.

Operators must titrate the threshold power. Threshold power should be a function of the location of treatment and the tissue environment. Focusing the slit lamp is essential for titration; the focus of the slit lamp and the laser should be as similar as possible in order to precisely administer the laser. The power is then titrated until the desired effect is achieved. This step is arguably the most important. Although lower power produces smaller scars, it also causes less regression of neovascularization.

<table>
<thead>
<tr>
<th>TABLE 1. PARAMETERS FOR PERIPHERAL AND MACULAR MULTISpot TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peripheral PRP</strong></td>
</tr>
<tr>
<td>Spot size</td>
</tr>
<tr>
<td>Power</td>
</tr>
<tr>
<td>Pulse duration</td>
</tr>
<tr>
<td>Contact lens</td>
</tr>
</tbody>
</table>
Too much power can lead to confluent spots and have a disruptive effect. The power is usually titrated upward until the operator observes tissue bleaching.

The operator will then have to choose the pattern, the spacing of the spots (from 0.5 µm to 0.75 µm for peripheral treatment; nonconfluent, barely visible spots for macular edema), and the number of spots. To achieve regression of neovascularization, 2000 to 6000 spots are generally used.

**EFFECT OF MULTISPOT TREATMENT ON THE MANAGEMENT OF RETINAL DISORDERS**

Whereas PRP with conventional laser used to take 3 sessions, PRP can be achieved in a single session with multispot laser.

Multispot treatment has changed not only laser photocoagulation but also global treatment strategies for retinal disorders. Conventional laser strategy required a laborious PRP, followed by phacoemulsification to remove a cataract, followed by a laser macular grid treatment with intravitreal injections to control secondary macular edema. This step-by-step treatment took more than 3 months. However, with multispot treatment, surgeons can perform phacoemulsification with intravitreal injection, followed by PRP within 1 month of surgery. This facilitates faster visual recovery for patients and creates more scheduling opportunities for surgeons.

**MULTISPOT PRP GENERAL RECOMMENDATIONS**

As multispot photocoagulation focuses many spots (and no longer a single spot), it is essential to use a specific PRP implementation strategy. I recommend the following:

1. Use a widefield laser lens instead of the classic 3-mirror lens.
2. Use a 400-µm (200 µm x 2) spot size and a 10-ms to 20-ms duration.
3. Space laser spots 0.5 µm to 0.75 µm from one another. (Focusing the beam in the periphery can sometimes be difficult because spots become confluent in this location. Increasing the spacing of the spots to 0.75 µm can control this.)
4. Treat the retina in 3 concentric zones instead of 5 or 6 radial zones (Figure 3).

Although 532-nm multispot treatment improves the management and treatment of patients with retinal disorders, it also has certain limitations. The primary constraint with the 532-nm multispot laser is that the beam disperses when a cataract is present. This problem can be resolved with the use of a 577-nm wavelength. Using a 577-nm laser and a 3 x 3 grid can also reduce glare during treatment, which is a drawback with the 532-nm wavelength.

**FUTURE**

Multispot laser treatment has had a significant and positive effect on photocoagulation and retinal disease management. The treatment is as effective as conventional laser treatment but is better tolerated by patients, produces fewer side effects, and has been shown to be safer.1,2 The treatment is also more comfortable for the surgeon to perform and reduces the overall duration of treatment.

A number of ongoing clinical studies are investigating the ability of this tissue-sparing treatment option to avoid scarring during the treatment of macular pathologies such as DME and central serous chorioretinopathy.

Sebastien Guigou, MD, is Chief of the Ophthalmology department at Henri Duffaut Hospital in Avignon, France. Dr. Guigou is consultant to Quantel Medical. He may be reached at sguigou@ch-avignon.fr.