

Evolutions in Laser Treatment

Dr. Nancy Holekamp

The Early Treatment Diabetic Retinopathy Study (EDTRS) established laser photocoagulation as the primary therapy for clinically significant diabetic macular edema (DME)¹, and the Diabetic Retinopathy Clinical Research Network confirmed that focal/grid photocoagulation should be the benchmark against which other treatments are compared.² Similarly, the ETDRS established panretinal photocoagulation as the standard of care for proliferative diabetic retinopathy and severe non-proliferative diabetic retinopathy (NPDR) of a level 53 or worse on the ETDRS severity scale.³ This article will address recent advances in panretinal laser photocoagulation.

The goal of panretinal photocoagulation is to prevent or cause regression of new vessel growth on the retina, optic nerve, or iris. For proliferative disease, heavy, dense laser burns are needed to reverse the VEGF-drive induced by ischemic retina. In recent years, dual frequency YAG diode lasers have been the standard for retinal treatment. More recent developments have brought to light the benefits of multiple impact lasers, which apply a group of preset impacts with a single pedal action. While the impacts are not simultaneous, four to 25 spots can be rapidly formed in less than 0.5 seconds with the Quantel Supra Laser. I have been using this Quantel laser in my practice for the last nine months.

The multispot laser has had a very positive impact on my treatment protocols, and in turn on my patients. With previous laser systems, I was limited to 250-500 laser spots at a time because of the discomfort felt by the patient. Thus, a full PRP treatment would require multiple visits or a retrobulbar block. No patient is enthusiastic to have an inch and a half needle placed behind the eye for retrobulbar anesthesia, and two to three separate visits is very time consuming for both the patient and the physician. The multispot laser is quick, painless, and I am easily able to create a nice PRP 1000 spot pattern in the peripheral fundus in under 10 minutes. It is a far better alternative both from a physician standpoint and a patient standpoint.

There has been some concern in the past that putting in a lot of laser spots at one time may predispose patients with diabetic retinopathy to macular edema. A clinical trial performed by the Diabetic Retinopathy Clinical Research Network analyzed the impact of a single sitting treatment of 1200 burns or more compared to multiple sittings of 300 burns each, and found that neither modality produced clinically significant differences.⁴

Without a clinical reason to divide PRP treatment into multiple sessions, the limiting factor is patient tolerance. It's too painful for some patients to get more than 300 or 500 spots in a sitting. These are the same patients that really do not want a retrobulbar block. It's better for the physician and patient to make 800 to 1000 spots in one sitting, and this is comfortable for the patient when using a multispot laser.

The multispot laser works with settings that are fairly high powered, but have a very short duration. It is common to start with a 200 micron spot size, but only a 0.01 second duration, as

opposed to a traditional 0.1 second duration. The much shorter duration is key to making it painless for patients. However, when the exposure to the laser is so brief, it is necessary to have a powerful laser in order to get a nice heavy burn that will destroy the retina and reduce intraocular VEGF. Laser power settings of up to 1 Watt may be needed to reach the desired endpoint of a detectable retinal color change. Surprisingly, with the multispot laser settings, this amount of laser intensity is well tolerated by the patient.

There have been some attempts to mimic the settings of a multispot laser with a standard thermocoagulation lasers and set it to 0.01 seconds and 200 microns, but generally that is still too painful for the patients, resulting in physicians turning down the power and not getting good laser spots.

The Quantel laser also comes with different pattern settings, allowing me to vary between a single spot or 25 spots at a time. The shape and angle of the grid can be changed, allowing a lot of flexibility and variability to tailor the treatment to the patient's fundus. While the 25 spot grid is not simultaneous, the time lapse from the first to the last spot is only about 0.5 seconds, making it very quick. For PRP, I commonly use a 9 or 16 grid pattern. That means I'm putting in nine or sixteen spots every time I hit the peddle as opposed to just one. That indicates how much more quickly you can get these laser treatments done.

Severe proliferative diabetic retinopathy requires more laser spots to reverse the VEGF drive, thus the use of the multispot laser. I've been using the multispot laser mostly for PRP but it has the same capacity to apply a grid pattern to ischemic areas in the macula. The spot size and distance between spots can both be reduced, tailoring the overall pattern to the affected area of the macula. For example, I may use a 100 micron spot size placed 100 microns apart in a semi-circle grid pattern to avoid the foveal center. The multispot laser can be used in other situations, alternating with the application of single impacts, such as for treating retinal tears. In fact, the Quantel Suprascan laser has classical laser capabilities in addition to newer multispot and micropulse capabilities, making Quantel a versatile instrument for any office laser procedure.

A good example of the flexibility of the Quantel Suprascan laser can be found in a particular patient with whom I started with classic conventional thermal laser treatment in the macula for diabetic macular edema. A subsequent fluorescein angiogram revealed that the patient had severe ischemia nasal to the optic nerve, which appeared to be responsible for a lot of the VEGF-mediated disease visible in the macula. Thus, with the patient still at the laser I was able to switch from a Mainster lens for my focal laser treatment with conventional thermal photocoagulation to a Volk-supra quad lens, which allowed me to use the multispot pattern scanning laser to conduct nasal PRP in the 16 grid pattern I prefer. All of this only took 5 – 10 minutes, demonstrating the flexibility of the machine.

I am currently using the Quantel Suprascan laser in an ambulatory surgery center with nurses that aren't accustomed to laser surgery. Even so, the machine is so straight-forward that all staff members have learned to use it very quickly. There is a touch screen that is simple to understand and the laser is very easy to operate. The laser fits onto most Haag Streit Slit lamps, providing for excellent optics and ergonomics. The Quantel unit is compact and fits on a small cart next to the slit lamp where it can be left attached without interfering with other functions. One of the

nicest aspects is the micro-manipulator for directing the laser beam. It is very well engineered and overall, an impressive and pleasant device to use.

The multispot laser offers the ophthalmologist greater flexibility, nice ergonomics, and faster treatment times. With multispot laser, the result for the patient is a shorter, less painful procedure with quicker recovery times. Laser photocoagulation is currently the gold standard for the treatment of proliferative retinopathies and the multispot laser is a welcome addition to my treatment armamentarium.

¹ Early Treatment Diabetic Retinopathy Study research group. Photocoagulation for diabetic macular edema. Early Treatment Diabetic Retinopathy Study Report No. 1. Arch Ophthalmol. 1985;103:1796-1806.

² Diabetic Retinopathy Clinical Research Network. A randomized trial comparing intravitreal triamcinolone acetonide and focal/grid photocoagulation for diabetic macular edema. Ophthalmology. 2008;115:1447-1459.

³ [No authors listed] Grading diabetic retinopathy from stereoscopic color fundus photographs— an extension of the modified Airlie House classification. ETDRS report number 10. Early Treatment Diabetic Retinopathy Study Research Group. Ophthalmology. 1991;98(5 Suppl):786-806.

⁴ Diabetic Retinopathy Clinical Research Network. An Observational Study of the Development of Diabetic Macular Edema Following Panretinal (Scatter) Photocoagulation (PRP) Given in 1 or 4 Sitzings. Arch Ophthalmol. 2009 February; 127(2): 132–140.

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