The subthreshold laser’s role in retinal vascular disease

By Netan Choudhry, MD
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Abstract / Synopsis:
A novel subthreshold laser provides seamless adjunctive therapy that can supplement or obviate the need for future injections in certain retinal conditions, explains Netan Choudhry, MD

Laser’s position in surgeons’ treatment armamentarium for diabetic eye disease has changed: once it was in the forefront; now, in the setting of injections—both anti-VEGF and steroids—laser is playing second or third fiddle. Its utility in a patient’s overall treatment strategy, however, is still important.

Subthreshold laser, referring to any subvisible laser photocoagulation, in general is underutilized as a treatment modality in retinal vascular conditions from diabetic macular edema to proliferative diabetic retinopathy to retinal vascular occlusion and central serous retinopathy.

Prior to the use of subthreshold technology, conventional continuous wave laser panretinal photocoagulation or PRP was used to reduce ischemic effects. PRP, however, led to retinal atrophy and thinning, sometimes creating scotomas and causing other complications.

Investigators soon learned how to apply the therapeutic effect of lasers while minimizing the damage. At the same time, they realized that it was not necessary to create full-thickness retinal damage to obtain a therapeutic benefit.

Conventional PRP laser uses longer-duration continuous wave therapy, delivering the same magnitude of energy during the entire treatment and causing significant collateral damage. Subthreshold laser, on the other hand, results in similar therapeutic benefits with no visible damage.
Subthreshold laser treatment

The laser’s hyperthermal energy stresses the retinal pigment epithelium in such a way as to cause a cellular cascade that produces a therapeutic benefit. Subthreshold therapy seeks to maintain the temperature below the threshold of irreversible thermal damage. Several techniques have evolved to apply energy in this manner.

Micropulse

Iridex introduced subthreshold MicroPulse Diode laser photocoagulation in the 1990s using an 810-nm laser.\textsuperscript{1} The energy is delivered in microsecond-long bursts of short, repetitive pulses, with periods of cooling in between. This technique allows effective subthreshold tissue-sparing laser treatments without visible burns to the RPE, and the surgeon can vary the power as necessary depending on the desired endpoint. The lack of choriotinal scarring allows the surgeon to apply treatments close together, and treatments can be repeated without causing noticeable retinal scarring.

EpM

The PASCAL pattern scanning laser (Topcon) uses pattern scanning with a shorter pulse duration of 10 to 30 milliseconds. At the correct power, temperature rises induce changes in various proteins leading to cellular damage, but not death. The EndPoint Management (EpM) system uses a computational model of retinal heating and the Arrhenius integral to determine optimal laser parameters.\textsuperscript{2} The EpM strategy begins retinal treatment with the titration of the laser power to a minimally visible threshold burn as a baseline. The treatment is defined as a percentage of this level, and then EpM adjusts laser power and pulse duration to this level. Many spots can be quickly placed.
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My experience

After originally using implementing Iridex subthreshold laser, my practice has used the Topcon laser with EpM for the past 2 years. Routinely, we incorporate subthreshold laser for patients with diabetic macular edema as well as other retinal vascular conditions like retinal vein occlusion and central serous retinopathy. My overall goal is to expedite a patient’s visual recovery and anatomical normalization as soon as possible. In a subset of patients, this is sometimes best achieved with combination therapy.

I find that subthreshold laser with EpM is effective following anti-VEGF therapy in patients who have a dry retina to help keep it dry and reduce the need for additional long-term injection therapy. Subthreshold laser is useful as adjunctive treatment in more challenging or recalcitrant eyes that have reached their response threshold with anti-VEGF and/or steroid shots.

Titrate power

With EpM, as compared with MicroPulse, the surgeon can visually titrate the amount of power that is needed for an individual eye, in real time. This means I can identify the minimum amount of power that I need to deliver to achieve a therapeutic effect. Other platforms without EpM require the surgeon spend time making additional and perhaps unnecessary spots, trying to achieve the correct power. Another benefit of EpM is the ability to apply anchoring burns to mark previous treatment.

At around the 8- or 12-week follow-up, I can typically see a therapeutic effect. In terms of endpoints, I am looking for, anatomically, the fluid resolving and a dry state post anti-VEGF. I also expect to see a visual improvement, as the presumption is that fluid accumulation participates in patients’ visual decline.
Outcomes, role

Vision is more than one’s ability to read an eye chart. Contrast sensitivity is important to patients although it is not something we measure in the office. It is, however, a component of patients’ perception of a visual improvement.

Certainly, patients are not lining up to have invasive procedures, and they all want visual recovery in the quickest and least complicated way possible.

Although injections remain a primary therapy for retinal vascular conditions, and some may have only a handful of injections and be virtually cured, sicker patients will require multimodal treatments.

Subthreshold laser provides seamless adjunctive therapy that can supplement or obviate the need for future injections in certain retinal conditions. We only have a handful of go-to treatments, so it is nice to have an alternative to injections that does not result in visual damage

The Topcon laser is not FDA approved for central serous retinopathy

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References: