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Current Role for Laser to Treat DME

BY VICTOR CHONG, MD

Laser photocoagulation has been the mainstay of treatment for diabetic macular edema (DME), but the introduction of the anti-VEGF drugs have led some to think laser is no longer an appropriate option. After an analysis of some of the clinical trials on the anti-VEGFs, it becomes apparent that laser is still widely used.

For instance, the Diabetic Retinopathy Clinical Research Network Protocol T study, where at baseline 35% to 40% of patients had previously undergone laser treatments. In this study, at 1 year 37% of those in the aflibercept group, 56% of those in the bevacizumab group, and 46% of those in the ranibizumab group had received laser and anywhere between nine and 10 injections.[1] In another DRCR.net study, Protocol I, more than 90% of the patients had laser by the end of the 5-year follow-up.[2]

The RESTORE study clearly showed the benefits of anti-VEGF therapies (see Figure 1).[3] There is no doubt that for patients with thick retinas, anti-VEGFs are truly beneficial. But the story changes when the retina is not thick.

The middle chart of Figure 1 is those with baseline central retinal thickness between 300 µm and 400 µm. If clinicians are doing numerous injections, there should be a greater separation in visual acuity than there is for those who were in the laser arm. The chart on the left of Figure 1 shows an even tighter visual acuity gain for those with very good maculas.

A subgroup analysis of the RESTORE study also showed that anti-VEGF injections seem to be more effective in those who had undergone laser treatment previously.[3] We do need to be cautious with our interpretations here—patients were enrolled in RESTORE if they were laser failures. Bearing that in mind, if patients had already failed one type of treatment but underwent that same treatment again, it is unlikely to have significant positive outcomes. All of which might explain why the anti-VEGF treatment on its own appeared to be a better treatment. For those who were laser treatment-naïve, however, outcomes were better after anti-VEGF treatment.[3]

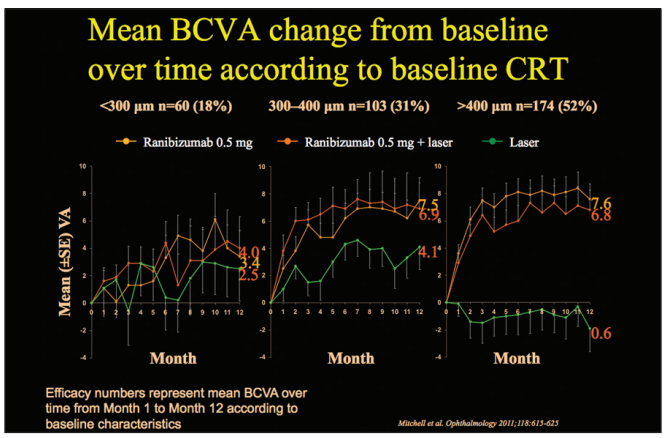

Figure 1. Mean visual acuity changes from baseline over time according to baseline central retinal thickness.[3]

These are but two examples that illustrate the continued need for laser treatments in those with DME.

Improving the way we do laser

Those above-mentioned studies discuss only conventional photocoagulation laser therapy. We know from a long history that conventional thermal laser causes damage to the retinal tissue. The 577 nm MicroPulse therapy, however, is fundamentally different as it is a subthreshold laser treatment approach.

I first started using MicroPulse laser more than 15 years ago, and our protocols for delivering the technology have altered as well. We have improved it over the years to make it more efficient, easier to do, and also safer. I currently use a 577 nm MicroPulse laser (Supra Scan 577; Quantel Medical). Figure 2 illustrates the treatment parameters I am currently using.

I recommend delivering the 577 nm MicroPulse confluent laser spots with the multispot delivery mode and densely treat the entire area of edema (optical coherence tomography [OCT]-guided treatment).

How close can we go?

Figure 3 shows a bit of edema and minor OCT changes in the macula. An angiogram confirms the microaneurysm is very close to the fovea. Conventional laser is not an option for this patient as a result. But the 577 nm MicroPulse was able to deliver an effective and safe treatment. I have no issues with using this laser close to the fovea.

577 nm MicroPulse follow-up?

In my hands, I tend to treat more than once if the edema covers a large area. I recommend a follow-up at 3 months and a retreatment of the persistent area of edema. Smaller edematous areas may be able to be treated with a single treatment, and I recommend follow-up at 6 months to confirm a retreatment (if necessary).

While it is probably possible to treat the fovea, I would recommend against it. I usually treat up to 100 microns from the fovea, or about one spot away.

Step 1	Step 2
TITRATE POWER USING MONOSPOT & MICROPULSE	**MULTISPOT & MICROPULSE TREATMENT SETTINGS**
-Spot Size: 160 µm	-Resume function activation
-Exposure Time: 0.2s (200ms)	-Spot Size: 160 µm
-Duty Cycle: 5%	-Spacing: 0
	-Exposure Time: 0.2s (200ms)
Increase of the power level (step by step) until reaching a just visible endpoint (barely visible threshold burn).	-Duty Cycle: 5%
	-Use **50%** of the power level reached during the titrate step for treatment.
Treatment is based on OCT thickness map, treat the entire area of edema. *NB: The most common cause of treatment failure is under treatment*	

Figure 2. Treatment parameters and process summary with the 577 nm MicroPulse laser.

Retreatment and the number of times it is possible is an ongoing debate. In my hands, I have treated patients as many as three times, but rarely have needed to treat anyone with more laser. There is some suggestion in the literature that multiple laser treatments are possible provided there is no scarring. If, however, the patient needs more than three treatments, it is possible there were other issues unidentified (including a wrong diagnosis). For instance, it has been suggested MicroPulse is not as effective in retinal vein occlusion; it is not uncommon for our DME patients to also have RVO.

Patience is mandatory when using the laser. I believe laser is a better option than anti-VEGFs for our DME patients because of the longer-lasting effect and because it is more affordable, but it will not work as quickly as the anti-VEGFs. Because there are two viable treatment options available for our DME patients, I recommend using them both.

Patients with center-involved DME and thick retinas can undergo anti-VEGF treatments followed by 577 nm MicroPulse laser to maintain the treatment and then reducing the frequency of the reinjections. But for those patients with non-center involved DME, the 577 nm MicroPulse laser should be considered a first-line treatment.

Because the 577 nm MicroPulse laser therapy works by stimulating the retinal pigment epithelial cells, physicians must select their cases carefully. Patients who have already undergone heavy conventional laser photocoagulation will need treatment over their scars and dead cells. In these cases, it is possible there would not be enough surviving cells to have the MicroPulse be advantageous. Patients with a great deal of edema might need treatment with an anti-VEGF first. And, finally, patients who have already failed anti-VEGF injections, steroids, and vitrectomy are unlikely to benefit from the 577 nm MicroPulse.

Undertreatment is common for new users of the 577 nm MicroPulse. Most of us have used conventional laser, and our habits with conventional laser transfer to the MicroPulse, but that will mean not enough laser spots. To be effective, the MicroPulse requires a dense delivery (no space between the spots) of a large number of laser spots. Using the treatment guidelines presented above, at a 160-µm spot size, users will need about 100 laser spots to treat over one disc area of edema. Look at the OCT map to determine how large of an area of edema needs treatment. If the edematous area is around four disc areas and you only deliver 200 spots (rather than 400 spots), the treatment is probably not going to work.

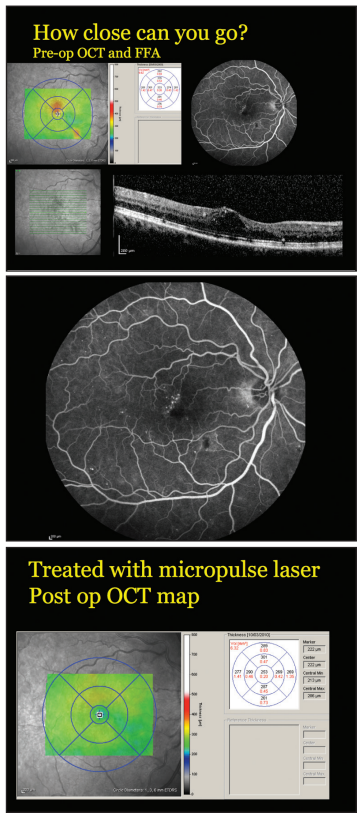

Figure 3. Treatment with the 577 nm MicroPulse laser close to the fovea.

Titrate the power

The power titration is an important step of the 577 nm MicroPulse laser procedure, and should be realized outside the edematous area (but nearby, in the flatter area). As discussed above, increase the power until a barely visible effect is noted then use 50% of that power level for the actual treatment. The "barely visible" effect may differ from case to case, so I recommend checking your own treatment results. Fluorescein imaging can be useful here to ensure there is no scarring. If scarring has been induced, it is recommended lowering the energy level slightly. ■

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1. Diabetic Retinopathy Clinical Research Network, Wells JA, Glassman AR, et al. Aflibercept, bevacizumab, or ranibizumab for diabetic macular edema. *N Engl J Med*. 2015;372(13):1193-1203.
2. Diabetic Retinopathy Clinical Research Network, Bressler SB, Glassman A, et al. Five year outcomes of ranibizumab with prompt or deferred laser versus laser or triamcinolone plus deferred ranibizumab for diabetic macular edema. *Am J Ophthalmol*. 2016; in press.
3. Mitchell P, Bandello F, Schmidt-Erfurth U, et al. The RESTORE study: ranibizumab monotherapy or combined with laser versus laser monotherapy for diabetic macular edema. *Ophthalmology*. 2011;118(4):615-625.