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A New Type of PRP for PDR

A surgeon shares his experience administering laser for patients with diabetes.

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The incidence of diabetes is growing to epidemic proportions, and with it, so are related diseases of the eye, such as retinopathy, macular edema, and glaucoma. In 2014, 29.1 million people (9.3% of the US population) had diabetes.

Of adults with diabetes aged 40 years old or older, 4.2 million (28.5%) people had diabetic retinopathy. Of adults with diabetes aged 40 years or older, 655,000 (4.4%) had advanced diabetic retinopathy — conditions including clinically significant macular edema and proliferative diabetic retinopathy.[1]

Treatments for advanced retinopathy are not exact; however, technology offers options to control neovascularization, which is the hallmark of PDR.

DIAGNOSIS

The typical patient with PDR is asymptomatic or has decreased vision from vitreous hemorrhage or macular edema. To confirm neovascularization, I look for leaking tufts or traction on fluorescein angiography.

Ultrawidefield fluorescein angiography is a great tool for identifying peripheral capillary dropout and neovascularization that is not always obvious on exam, which may help target areas to laser. Tailoring panretinal photocoagulation treatment to ischemic retina is thought to lower VEGF levels while sparing healthy peripheral retina.

Additionally, I obtain an optical coherence tomography scan to diagnose macular edema because it may need to be treated simultaneously. OCT can also show if a tuft of neovascularization is exhibiting traction on the retina.

TREATMENT

Once PDR is diagnosed, I perform PRP, which destroys the oxygen-demanding photoreceptors and allows oxygen from the choroid to bypass them to supply the ischemic inner retina, thus reducing the demand for neovascularization.

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Often the view is limited by vitreous hemorrhage but I have had good success clearing hemorrhages nonsurgically with an anti-VEGF injection to allow for earlier PRP. I always perform a B-scan ultrasound first though to ensure there is no traction on the retina, because the rapid regression of neovascularization caused by the injection can actually worsen an early tractional

retinal detachment.[2]

Another time to use injections with PRP is cases of neovascular glaucoma. Injecting a half dose of anti-VEGF into the anterior chamber can rapidly decrease neovascularization of the iris and lessen intraocular pressure, provide a much clearer view for PRP.[3] Anti-VEGF results are short-lived, however, although use of these drugs can be a useful temporizing measure before vitrectomy for PDR.[4]

Vitrectomy is reserved for nonclearing vitreous hemorrhages or macula-threatening tractional detachments. Surgical removal of the neovascular membranes is much easier if an injection is administered 5-8 days beforehand. Endolaser at the end of surgery can be much more thorough and targeted than in the clinic, so this is a good opportunity to treat ischemic retina.

For PRP, I use the IQ 577 laser system (Iridex Corp., Mountain View, CA) in its continuous wave (CW) mode to perform what I refer to as "mini" or "milli" pulse.

Simply described, the minipulse is a kinder, gentler version of PRP; it is a reduction in the duration of CW laser delivery, with a shorter interval between laser pulses. Note that this is different from MicroPulse technology (Iridex), which is an optional treatment mode with the IQ 577 laser **(Figure 1).**

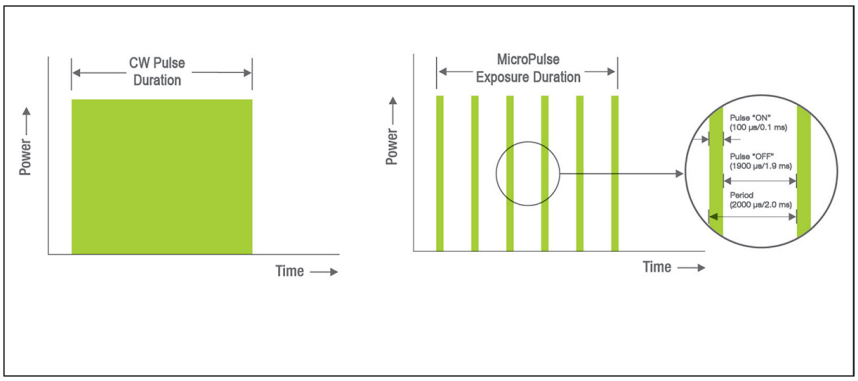

Figure 1. MicroPulse technology finely controls thermal elevation by "chopping" a continuous wave laser beam into an envelope of repetitive short pulses.

MicroPulse technology finely controls thermal elevation by "chopping" the CW laser beam into a train of repetitive microsecond pulses, allowing tissue to cool between pulses and reducing thermal buildup. It is used primarily for macular cases because it prevents damage to photoreceptors and retina.

Conversely, when treating PDR, the laser must be powerful enough to damage the oxygen-deprived area of the retina and to reduce the oxygen demand but gentle enough to prevent tunnel vision resulting from excessive damage to the retina.[5,6]

With the minipulse, I set my duration for 20 msec, which is approximately one-tenth of what I used when performing standard PRP. The interval is set to 80 msec, roughly half that of standard PRP. I titrate my power but rarely above 250 mW; the 577-nm wavelength gives me similar results as 532 nm with less power.[7] Each individual burn is faster and makes the overall treatment much shorter. I find that I am able to cover a larger area of the retina in a much shorter time period.

The most important advantage is that it is significantly less painful for the patient.[8] When performing standard PRP, it was necessary to administer an anesthetic block injection to alleviate the pain. With the 577-nm minipulse, this injection is no longer needed because patients tolerate the treatment quite well.

I achieve the same neovascularization regression as I did using traditional PRP power levels, usually with just one treatment session. With standard PRP, I often staged treatment over two sessions due to length of time each treatment required and the pain for unblocked patients.

These issues slowed down my clinic day and constituted a burden on my patients and their families.

A SLOWER FIX

PDR is years in the making, so it is no surprise that the effects of the laser take weeks to months to become noticeable. There has been no head-to-head study of shorter-duration PRP vs standard PRP efficacy, although "bleeding" of spots over time seems to be reduced.[9] I do feel the neovascularization regression is similar but slower with my short-duration spots, compared to standard. Published series of micropulse PRP have had similar, yet slower, success.[10] Neovascularization regression has been shown to be quickened with an adjunctive anti-VEGF injection.[11]

This combination can be especially useful in a monocular patient or one with high-risk PDR who has failed to respond to prior PRP. Although the treatment is permanent, patients may develop more ischemia, regardless of the level of treatment, so they must be monitored.[12]

CASE DISCUSSION

A 49-year-old man with a 37-year history of type 1 diabetes complained of floaters. He had undergone standard PRP OU 10 years earlier. An exam indicated minor macular edema, vitreous hemorrhage, and neovascularization. The vision was 20/70 OD, and the A1C (blood sugars) was at 9.5%.

The patient opted for PRP and MicroPulse laser therapy on the macula. The macula responded well, and vision improved to 20/40. I used minipulse PRP to minimize additional loss to his peripheral vision. The hemorrhage dissipated and has not returned, despite continued poor glycemic control.

NOT TOO MUCH, BUT NOT TOO LITTLE

The science of neovascularization is not exact. There is a fine line between peripheral vision compromise from overtreatment and advancement of retinopathy from undertreatment. With my 577-nm minipulse technique, the surgeon gets the best of both worlds: neovascularization is resolved, treatment time is shorter, and patients have less vision loss. Patients are happy to complete the treatment in one session, without anesthesia and little discomfort, and the technique requires significantly less chair time.

Looking forward, we may have more pharmacologic options for PDR. Adjunctive anti-VEGF is a very useful tool now for PRP and for vitrectomy for PDR.[13,14] Extended release anti-VEGF and steroids may be able to control the disease without monthly injections. Bevacizumab (Avastin, Genentech, South San Francisco, CA) has been used for the peripheral retinal ischemia in retinopathy or prematurity successfully, without sacrificing the temporal retina with dense laser.[15] Although PDR is a different beast, we may have more options to supplement laser in the future. **RP**

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