Micropulse Laser Therapy For the Treatment of DME

A less destructive laser may offer greater benefits for treating edema.

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As a disease defined by high blood glucose levels that affect the body's ability to produce or use insulin,[1] diabetes afflicts 25.8 million children and adults in the United States. As many as 79 million Americans have prediabetes.[2]

In 2012, the cost of diagnosed diabetes in the United States was $245 billion.[2] This enormous economic impact, due to the cost of treatment in addition to lost work productivity, has led to diabetes becoming one of the leading healthcare concerns globally.

Although proliferative diabetic retinopathy can lead to neovascular glaucoma, cicatricial retinal detachment, and vitreous hemorrhage, the majority of vision loss in diabetes is still due to diabetic macular edema and the leakage of microaneurysms in the central macula.

Because diabetic retinopathy has become the leading cause of new blindness in adults in their prime years of life, many studies have been undertaken to develop treatment options to slow its progression.

LASER THERAPY

The Early Treatment of Diabetic Retinopathy Study (ETDRS) was among the first studies to evaluate the use of laser treatment to slow the progression of DME and vision loss. It concluded that laser photocoagulation is beneficial in the treatment of DME.[3]

A milder, but more extensive, laser technique was subsequently proposed to minimize possible side effects, such as inadvertent foveal burn, enlarged scar formation, expanded scotoma, and choroidal neovascularization,[4,5] and the modified EDTRS protocol is still the most prominent treatment guideline today.[6]

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PHARMACOTHERAPY

In more recent years, pharmacotherapy injections — particularly the use of anti-VEGF — have been advocated for the treatment of DME and other retinal diseases, involving vascular etiologies. The RISE and RIDE studies examined the efficacy of ranibizumab (Lucentis, Genentech, South San Francisco, CA) for treatment of DME, demonstrating that it improved vision, reduced the risk of further vision loss, and improved macular edema with less likelihood of developing PDR, compared to sham injections.[7] Improvement in mean BCVA and decreases in central foveal thickness (measured on OCT) have led to the use of ranibizumab as a first-line therapy for the treatment of DME. Injections show results rapidly, often resulting in a "wow" effect for both patient and physician.

However, therapy may require frequent and ongoing injections, and side effects can include endophthalmitis, retinal detachments, increases in intraocular pressure, thromboembolic events, and even fatal events in DME patients.[7] Other studies regarding the use of anti-VEGF for the treatment of DME have included the DRCR.net's Protocol I, which demonstrated combination anti-VEGF and continuous wave (CW) laser was better than CW laser alone for patients with DME at one year.[8,9]

Similar studies with comparable results included READ-2,[10,11] RESOLVE,[12,13] and RESTORE,[14] which looked at edema involving the central macula.

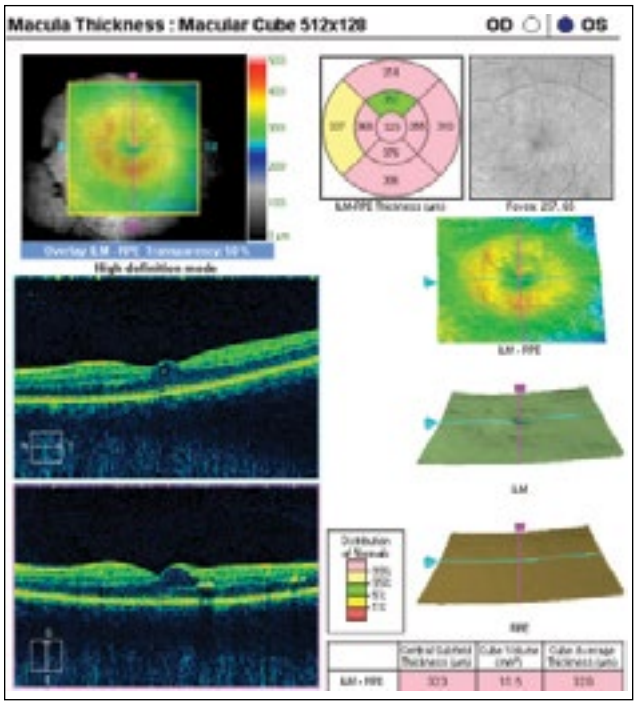

Figure 1. Patient A with type 1 DM and DME, pre-MPLT with visual acuity of 20/20.

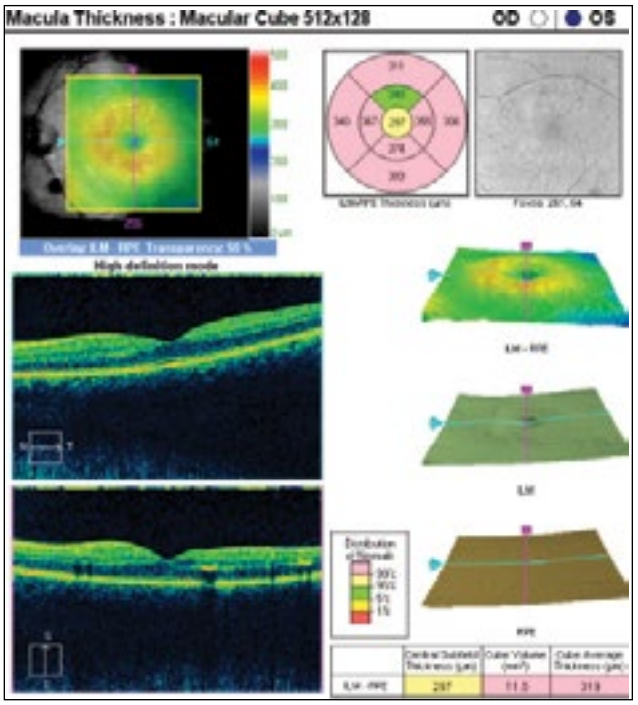

Figure 2. Patient A, post MPLT one month after treatment, with resolution of DME and visual acuity of 20/20. The patient had no anti-VEGF treatment at the time of MPLT.

On the horizon is the DA VINCI study, a phase 2 trial utilizing aflibercept (Eylea, Regeneron, Tarrytown, NY) for the treatment of DME, which has demonstrated significant gains in BCVA compared to laser alone in early reports.[15]

FIRST, DO NO HARM

Another treatment option for DME includes the use of micropulse laser therapy (MPLT) (Iridex, Mountain View, CA). MPLT utilizes technology that chops a CW laser beam into a train of repetitive microsecond pulses, allowing tissue to cool between pulses to reduce thermal buildup.

Micropulse laser induces a stress response that results in antiangiographic activity without the thermal destruction the conventional CW laser or subthreshold CW laser can cause. Research has shown that destruction of retinal pigment epithelial cells is not necessary to produce a therapeutic result.[16]

Further, studies have also shown MPLT to be as effective for treating DME as conventional, more damaging photocoagulation[17-19] and that MPLT can improve visual sensitivity.[17] However, head-to-head studies of MPLT vs pharmacotherapy have not yet been undertaken.

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In my practice, if the patient presents with clinically significant macular edema, I prefer to begin with anti-VEGF therapy for several sessions to help reduce the DME faster and restore BCVA. I will then augment treatment with MPLT to maintain the effect of anti-VEGF therapy longer and to aid in the removal of persistent DME, especially subfoveal.

I feel comfortable knowing that I am not creating any thermal damage in the fovea and that I may be able to reduce the amount of anti-VEGF treatments needed in the future for a given patient.

Many patients with the disease are resistant to having intraocular injections or who are at high risk for systemic side effects associated with anti-VEGF therapy. For these patients, I choose to perform MPLT as the initial therapy (**Figures 1-3**).

Micropulse laser can be delivered directly over areas of edema, including the central fovea. The effect of the laser is not as fast as anti-VEGF therapy and may require several months to obtain the desired result. However, the effects of the MPLT appear longer lasting than anti-VEGF therapy alone.

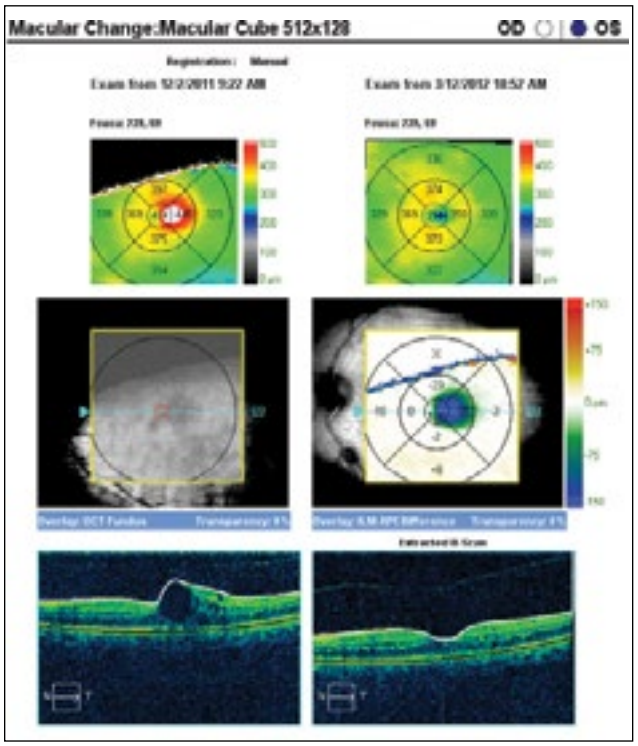

Figure 3. Patient B with type 2 DM, pre-MPLT and three months post-MPLT. Visual acuity went from 20/50 to 20/30 with resolution of DME. The patient had no anti-VEGF treatment at the time of MPLT.

Because MPLT does no damage to the tissue, I can add an additional treatment in three to six months, if indicated. I can follow patients clinically and with OCT for the resolution of DME.

My current treatment protocol for the Iridex IQ532 laser with micropulse is as follows: I begin with the laser set in traditional CW settings. After placing a Mainster lens on the eye, I place a test spot in a nonedematous area of the retina, using a 100-µm spot size, 100-msec duration, and 100 mW of power.

I then titrate the power up by 10-50 mW, moving to a new area each time, until I note a thermal reaction (white burn). I then switch the laser to the micropulse setting and place it into a 5% duty cycle. I maintain the 100-µm spot size and double the duration and power. I then perform MPLT over the area of edema with a high-density grid treatment.

THE SHIFTING DME TREATMENT PARADIGM

With so many different modalities available for the treatment of DME, choosing the best treatment for a given patient can be difficult. Since the development of anti-VEGF therapy and a better understanding of the mechanism of action, we have been able to improve patient outcomes and slow the progression of DME in many diabetic individuals.[20]

However, we must be cautious when using anti-VEGF therapy in some patients who may be compromised systemically. As physicians, our first goal in any treatment is to do no harm. For me, MPLT, utilizing the IQ 532 laser, has made the treatment of DME safer and more effective than anti-VEGF treatment alone or with CW laser. RP

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