As anyone in medical practice sees on a daily basis, there is an increase in the incidence of diabetes and diabetes-related complications among our patients. This is due in part to earlier diagnosis and screening programs, but also to an increase in obesity and life expectancy. So acute is the problem that the World Health Organization added diabetic retinopathy to its priority list of diseases.1

Just 4 decades ago, most people diagnosed with diabetes would likely go blind if they lived long enough because there were no safe and effective treatments for managing associated ocular diseases. Available treatments were associated with risk of significant complications.2

The advent of retinal photocoagulation heralded a tremendous change in treatment; for the first time, there was a way of at least managing the progression of retinal disease in patients with diabetes.3 Laser therapy combined with early screening and effective control of the disease led to a decrease in the number of patients who required more severe treatments, such as vitrectomy.

The history of this field has been a sequence of increasingly subtle treatments applied at earlier points in the disease process.

A Q-switched Nd:YAG laser may allow treatment earlier and closer to the fovea than standard laser photocoagulation.

BY JOHN MARSHALL, PhD, FRCPATH, FRCPHTh(Hon); LUCIA PELONSIS, MRCPHTh; PETER HAMILTON, FRCS, FRCPHTh; AND ROBIN HAMILTON, MBBS, MRCPHTh

RETINA REGENERATION THERAPY

Nonthermal Retina Regeneration Therapy (2RT; Ellex, Adelaide, Australia), is a short-pulsed laser treatment that is intended to treat diabetic maculopathy and macular edema at an earlier stage of the disease. The therapy may also have application in the treatment of early-stage age-related macular degeneration. (For more information, see 2RT in Treatment of Age-Related Macular Degeneration.)

The laser used for 2RT is a Q-switched, green Nd:YAG laser with a wavelength of 532 nm. Its pulse duration is 3 nanoseconds with energy of 1 µJ per pulse. The laser treatment triggers what we describe as photoregeneration of the retinal pigment epithelium and Bruch’s membrane—the areas responsible for keeping retinal function optimized—without damaging peripheral areas.

The laser was developed as a result of preclinical proof-of-principle laboratory work at Saint Thomas’ Hospital.4 Ellex has since received an Australian government grant to expand the laboratory and clinical research on the 2RT.

Not only can the laser treatment be placed closer to the fovea; equally significant, the 2RT can be used earlier...
in the disease process, offering the potential to preserve a greater degree of functional vision for a longer time.

**CLINICAL RESULTS**

In the first clinical study of the procedure, 29 eyes (18 patients) underwent 2RT for the treatment of diabetic maculopathy and/or macular edema. Currently, patients are being followed for 1 year. Postoperative testing includes optical coherence tomography and microperimetry.

At 3 months, most patients showed improvement in visual acuity and decrease in central macular thickness. Central macular thickness decreased in 55% of eyes and remained stable in 24%. The remaining 20% experienced an increase in central macular thickness. There was a mean improvement in logMAR visual acuity from 0.3 to 0.1. Microperimetry demonstrated no laser damage to photoreceptor cells.

The energy initially used in the 2RT treatment was 120 mJ/cm²; however, it triggered a reaction in the retinal pigment epithelium (RPE). The treatment was then reduced by half to create the desired effect without causing a visible reaction in the RPE.

**DISCUSSION**

Although this is a preliminary study, early results are encouraging. Consider that in the past, preservation of central vision with laser photocoagulation destroyed, to some extent, the peripheral vision. This put significant limitations on the location and timing of laser photocoagulation—not too close to the fovea, not too early in the course of the disease. With 2RT, there is potential to develop a laser treatment that affects only the RPE without damaging the photoreceptor cells, meaning that we can get closer to the fovea without damaging central vision. For the first time, there is the potential for a prophylactic treatment approach in patients with diabetic macular edema or maculopathy.

Further clinical studies are underway in the United Kingdom and Australia, with expansion to follow to additional international sites throughout 2008. If these additional clinical studies achieve the results seen in the London study, Ellex plans to move forward with commercial introduction of the technology.

The promise of earlier therapeutic intervention for diabetic maculopathy and macular edema is significant. The ability to treat the whole ischemic retina and preserve visual function for as long as possible is a long-sought goal whose time may soon arrive.

Peter Hamilton, FRCS, FRCOphth, is an Honorary Consultant at Moorfields Eye Hospital and Honorary Consultant at Saint Thomas’ Hospital. Dr. Hamilton states that he has no financial interest in the products or companies mentioned.

Robin Hamilton, MBBS, MRCOphth, is a Fellow in Medical Retina at Moorfields Eye Hospital and an Honorary Fellow at Saint Thomas’ Hospital. Dr. Hamilton states that he has no financial interest in the products or companies mentioned.

John Marshall, PhD, FRCPath, FRCOphth(Hon), is the Frost Professor of Ophthalmology and Chairman of the Academic Department of Ophthalmology, Kings College London at Saint Thomas’ Hospital, and was Sembal Professor of Experimental Ophthalmology at the Institute of Ophthalmology from 1982-1991. Professor Marshall states that he is a member of the Ellex Board of Directors and is compensated in this role. He may be reached at e-mail: marshall-eye@kcl.ac.uk.

Lucia Pelonsis, MRCOphth, is a clinical fellow at Saint Thomas’ Hospital. Dr. Pelonsis states that she has no financial interest in the products or companies mentioned.

---