• Toxic Maculopathies - Plaquenil Toxicity (Early)

This 36-year female had been taking Plaquenil for rheumatoid arthritis for approximately ten years. She had begun to notice an overall decrease in her vision over the past several months. She had been examined elsewhere on several different occasions and had been told her examination was normal. She presented for another opinion. Her visual acuity was 20/20 in both eyes. Funduscopic examination and fluorescein angiography were essentially normal except for very subtle RPE changes noted in the macula in both eyes **(Figure 24)**. The standard perimetry (Humphrey Visual Field) did not show any scotoma or decrease in sensitivity. An MP-1 was performed on both eyes and discovered a significant diffuse decrease in macular sensitivities in both eyes **(Figure 25)**. This was confirmed on repeat testing. The Plaquenil was discontinued. Three months later repeat MP-1 showed a normalization of macular function **(Figure 26)** and resolution of the patient's complaints.

Figure 24: Fundus photo showing very subtle RPE changes.

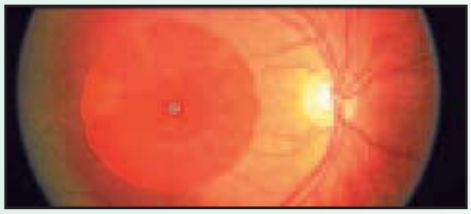

Figure 25: Microperimetry showing dense central scotoma.

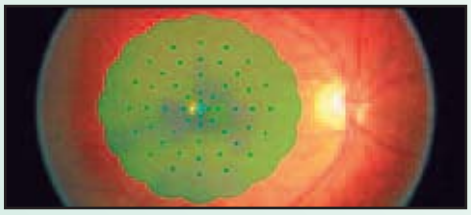

Figure 26: Microperimetry after dicontinuing Plaquenil® with resolution of scotoma.

• Toxic Maculopathies - Plaquenil Toxicity (Advanced)

This 48-year old female had been prescribed Plaquenil for rheumatoid arthritis for the past 15 years. She had been intermittently followed over the last 5 years. She presented with complaints of a significant decrease in vision in both eyes over the last 6 months. Her visual acuity was 20/200 in both eyes. Funduscopic examination and fluorescein angiography demonstrated RPE alteration and the "bull's-eye" appearance of a toxic maculopathy **(Figures 27, 28)**. MP-1 microperimetry was performed and showed a diffuse dense central scotoma in both eyes **(Figure 29)**. The Plaquenil was discontinued. The patient, however, did not experience any improvement in her visual acuity.

We are now using the MP-1 microperimetry as our primary scanning perimetry for all of our patients on Plaquenil treatment.

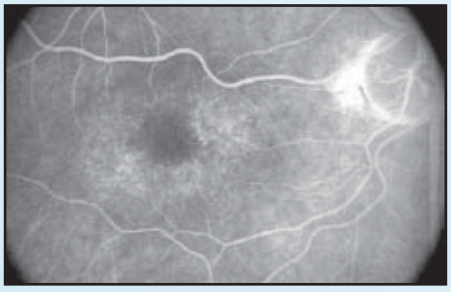

Figure 27: Fluorescein angiogram demonstrating diffuse macular hyperfluorescence secondary to Plaquenil® toxicity.

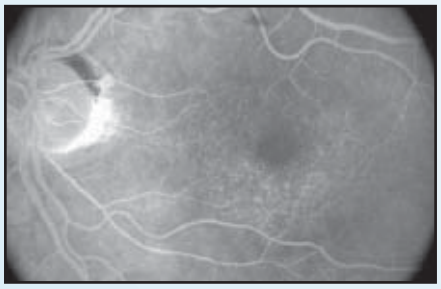

Figure 28: Fluorescein angiogram demonstrating diffuse macular hyperfluorescence secondary to Plaquenil® toxicity.

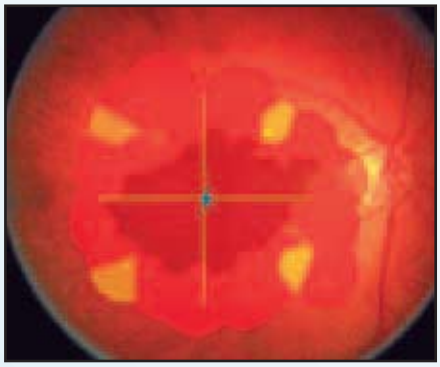

Figure 29: Microperimetry demonstrating diffuse central scotoma associated with toxicity.

Summary

These cases are a few examples of how the MP-1 Microperimetry (Nidek) is a useful adjunct in the diagnosis, treatment and follow-up of patients with macular diseases. It is clinically applicable in evaluating scotoma size, both absolute and relative, evaluating fixation patterns, and monitoring retinal function. It can also be useful in evaluating macular patients, both preoperatively and postoperatively, and evaluating the effectiveness of any macular treatment. Locating both the location and size of scotomas in low vision patients can also be very helpful in visual rehabilitation.

We have found the MP-1 useful in dealing with a variety of macular diseases, from determining the effectiveness of PDT treatment in patients with wet macular degeneration to evaluating the possibility of laser treatment in an area of recurrence of a subretinal neovascularization and whether it would affect the patient's fixation pattern or preferred retinal locus (PRL). From the evaluation of patients with macular dystrophies to macular edema, from macular puckers to macular holes, the MP-1 can be very useful in determining visual function. At present, several prospective studies are on going evaluating the effectiveness of MP-1 in patients following photodynamic therapy treatment, macular hole surgery (with or without membrane peeling) and in patients taking Plaquenil. These studies will hopefully further elucidate the usefulness of this new technology.

VOLUME 33, Number 4

The MP-1 Microperimeter

Clinical Applications in Retinal Pathologies

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SENIOR EDITOR'S NOTE

Dr. Nelson Sabates is one of the most outstanding clinical researchers of the younger generation in the United States in the field of medical retina and macular diseases. HIGHLIGHTS presents his experiences with the MP-1 Microperimeter, a unique instrument that combines fundus tracking microperimetry with color fundus photography in a single instrument, manufactured by NIDEK. This instrument replaces the usefulness of the Rodenstock Scanning Laser Ophthalmoscope (SLO), which several years ago was considered one of the most significant diagnostic developments for the study of macular diseases. The SLO was a very complex machine that helped determine the size and location of scotoma and assessed fixation behavior. Unfortunately, although very capable, it was not very reliable. It was very expensive to buy and maintain. It also lacked flexibility and is no longer manufactured.

The MP-1 Microperimeter was developed by a group of European SLO users who wanted a richer feature set as well as color photography.

The MP-1 Microperimeter is a useful adjunct in the diagnosis, treatment and follow-up of patients with macular diseases. It is clinically applicable in evaluating scotomas size, both absolute and relative, studying fixation patterns, and monitoring retinal function. It can also be useful in evaluating macular patients, both preoperatively and postoperatively, and assessing the effectiveness of any macular treatment. **BFB**

The assessment of visual function is extremely important in evaluating the progression or extent of any eye disease. It is also important in evaluating the effectiveness of any treatment modalities.

Visual function has traditionally been evaluated by assessing visual acuity. Visual acuity, however, is not sensitive enough to quantify human visual function and its impairment in relation to daily life activities.

Morphological analysis by fundus photography, on the other hand, does not allow quantitative evaluation of the "quality" of visual function and therefore it does not allow us to measure changes in retinal functions.

Use of Standard Perimetry

Perimetry has also been a useful test to assess visual function. The gold standard for traditional perimetry is the Humphrey Visual Field Analyzer. Perimetry data is obtained by having the patient look at a fixation target. Stimuli are presented relative to that target with a projector, the light reflects off of the bowl of the instrument and onto the patient's retina. As long as the patient maintains adequate fixation, the results are very reliable and repeatable. This works quite well for glaucoma patients, as central vision is the last to be affected. In retina patients, we often see just the opposite scenario, the central vision is often the first to be affected. This poses significant problems for standard perimeters. The patient is unable to fixate on the target. The eye begins to search. Once this happens, you cannot assure exactly where you are projecting the stimulus with any degree of certainty. As a result, the perimetry data is questionable at best, useless or misleading at worst.

Why Microperimetry?

Microperimetry examination of the macula would be an ideal tool to measure scotoma size, central sensitivity, and fixation behavior in patients with macular disease **(Figure 1)**. The end product of perimetry and microperimetry exams is a sensitivity map of the examined retina. This is obtained by measuring the patient's ability or inability to perceive light of varying intensities projected on different areas of the retina.

First Attempts at Microperimetry

The first instrument to address this need was the Rodenstock Scanning Laser Ophthalmoscope (SLO). The SLO was a very complex machine that in principle and design helped determine the size and location of scotoma and assessed fixation behavior. For this case we present an example of a patient with a subfoveal subretinal neovascular membrane that underwent successful submacular surgery. Preoperative scanning laser ophthalmoscopy demonstrated a large central dense scotoma (ds) with fixation displaced superior nasally **(Figure 2).** Postoperative scanning laser ophthalmoscopy demonstrated a smaller dense scotoma (ds) with a small relative scotoma (rs) and reinstatement of central fixation **(Figure 3).**

Unfortunately, the SLO although very capable was not very reliable. It was very expensive to buy and maintain. It also lacked flexibility and is no longer manufactured.

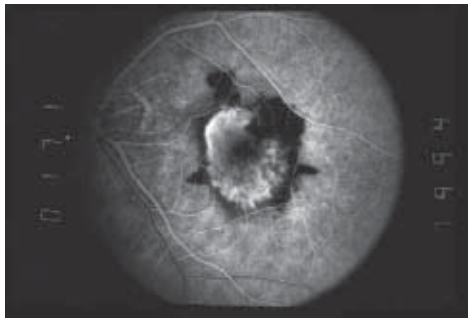


Figure 1: Fluorescein Angiogram - Subfoveal SRNVM

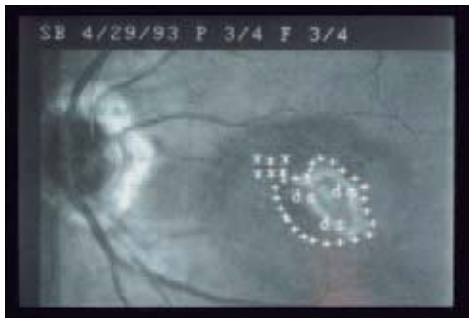


Figure 2: Preoperative SLO

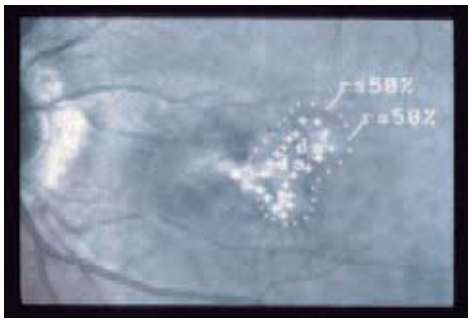


Figure 3: Postoperative SLO

Figure 4: MP-1 Microperimeter

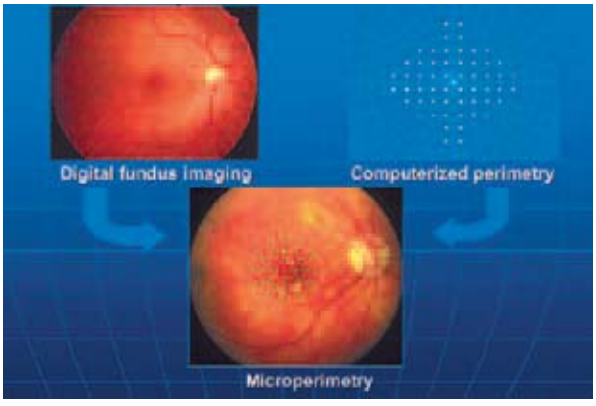


Figure 5: Microperimetry -Fundus Photography and Perimetry

Microperimeter (MP-1)

The MP-1 microperimeter (**Figure 4**) combines fundus tracking microperimetry with color fundus photography in a single instrument (**Figure 5**). It was developed by a group of European SLO users who wanted a richer feature set as well as color photography.

The MP-1 initially takes an infrared photograph. The software package allows the operator to select a biological landmark of high reflectivity under infrared i.e., the branch of a retinal vessel.

This image is then digitally registered and matched with the corresponding area on the live video of the patient's retina. All stimuli are projected directly onto the retina in relation to this land mark, using a LCD. Adjustments for eye movements are made at 25 times per second. This active tracking allows the MP-1 to get reliable perimetry data even when the patient is unable to fixate. If the MP-1 loses tracking, it will stop projecting stimuli until active tracking is re-established. When the exam is complete, a color photograph is taken. A similar registration technique is used to overlay the visual field data over the fundus photo. This makes it easy to correlate the pathology with the scotoma. The MP-1 allows the reporting to be numerically in decibels, schematically or in a color scheme (**Figure 6**).

This same technology allows the MP-1 to actively track and map the patient's fixation. There is also a separate fixation exam available that requires less than one minute to perform. This software automatically and accurately maps the location and quality of a patient's fixation (**Figure 7**). We are finding fixation analysis to be an invaluable tool to assess the quality of vision and the efficacy of treatment, as well as being prognostic in the efficacy of treatment. We would like to demonstrate the usefulness of the MP-1 in the diagnosis, treatment, and follow-up in some examples of macular diseases.

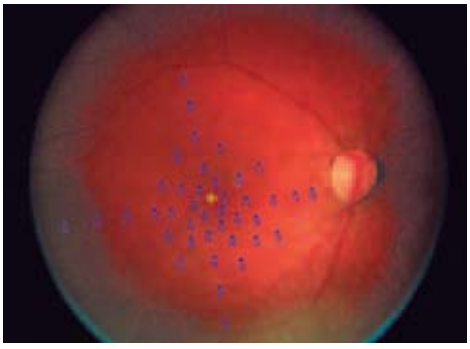


Figure 6: Normal Microperimetry -Decibel report.

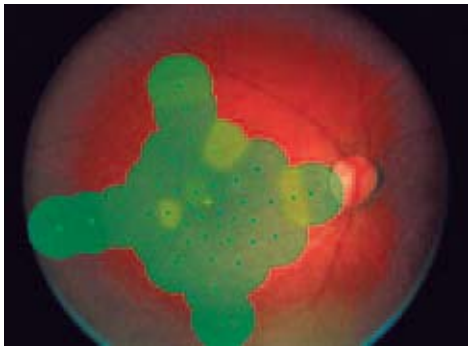


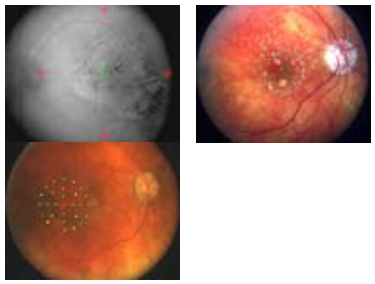
Figure 7: Normal Microperimetry - Color Scheme

Enclosure 4, page 4

Micro Perimeter MP-1

Download Brochure

MP-1 Microperimeter - The New standard in Retinal Diagnostic



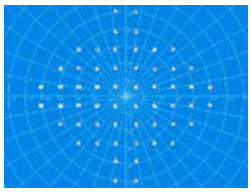
More detailed information on MP-1
www.nidektechnologies.it

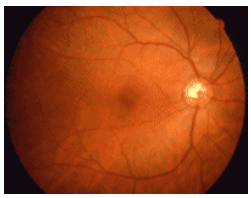
ARTICLE (August 1, 2005):

The MP-1 Microperimeter Clinical Applications in Retinal Pathologies (733KB)
Courtesy of S. Boyd, MD; BF Boyd, MD, HIGHLIGHTS OF OPHTHALMOLOGY Journal, English Ed., 2005;33:4;12-17.
www.thehighlights.com

Combined Perimetry & Fundus Imaging

- Accurate, fully automatic assessment of the macular function is achieved by effectively integrating in a single instrument the objectivity of fundus imaging and the subjectivity of computerized perimetry.





Computerized Microperimetry

- Accurate detection and measurement of visual sensory outcomes.
- A flexible and user programmable set of parameters specifies the stimulus intensity, shape and size along with foreground and background color.
- Fully automated examination with selectable target strategies.