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SHORT COMMUNICATION

Macular sensitivity change in multiple sclerosis followed with microperimetry

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PURPOSE. *To describe the efficacy of MP-1 in detecting early multiple sclerosis (MS) retinal lesions and in monitoring the effectiveness of treatment in terms of changes in macular sensitivity.*
METHODS. *A 21-year-old woman with MS was referred to us complaining of recurrent episodes of eyesight loss in both eyes. At ophthalmologic examination, best-corrected visual acuity was 20/25 bilaterally; ophthalmoscopy showed bilateral slight optic neuritis without swelling of the disc. Static perimetry of central visual field (30 degrees, by Octopus 101, Haag-Streit AG, Switzerland) and retinal sensitivity of the 12 central degrees (by MP-1 Micro Perimeter, Nidek Inc., Italy) were performed on the patient at that time. The microperimeter (MP-1) showed a loss of sensitivity in the macular region with 0.28±0.9 dB sensitivity in the right eye and 19.42±1.5 dB in the left. The mean fixation stability was 91% considering 2° and 99% considering 4° around the fixation points in the right eye, and 97% in 2° and 100% in 4° central degrees in the left. In the weeks that followed vision continued to get worse in both eyes, so she underwent a steroid therapy with methylprednisolone IV 1000 mg/day for 5 days and 500 mg/day for 3 days.*
RESULTS. *After 8 days of therapy the MP-1 showed a significant recovery in the right eye, with mean light sensitivity being 19.61±1.3 dB in the right eye and 20.0±0 dB in the left eye in both macular and peripapillary regions. The mean fixation stability was 100% considering 2° and 100% considering 4° around the fixation points in both eyes.*
CONLCUSIONS. *The MP-1 can be an interesting tool for neuro-ophthalmologists as it allows a more precise evaluation of the macular and peripapillary region, which is not easily studied with conventional automated perimetry. In MS, the presence of a subclinical form of optic nerve involvement can be demonstrated in a very early stage, and well followed by the introduction of microperimeter testing in the standard examination protocol. (Eur J Ophthalmol 2007; 17: 441-4)*

KEY WORDS. *MP-1, Microperimetry, Multiple sclerosis, Changes in macular sensitivity*

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INTRODUCTION

Multiple sclerosis (MS) is an inflammatory demyelinating disease of the central nervous system white matter, mediated by an autoimmune process (1). In addition to systemic neurologic symptoms, this demyelinating condition may give rise to ocular findings, including abrupt loss of visual acuity, reduced contrast sensitivity, dyschromatopsia, ocular pain, and visual field loss (2). Although most visual functions show substantial recovery within 6 months from the onset, some residual visual field loss is common, due to a damage of retinal nerve fibers. Such loss is classically detected by visual field indices derived from automated static threshold perimetry, which can also show a decrease in macular sensitivity (3). However, the macular sensitivity can be better measured using the recently introduced fundus-related microperimeter (MP-1). MP-1 provides a quantitative analysis of the fixation status and

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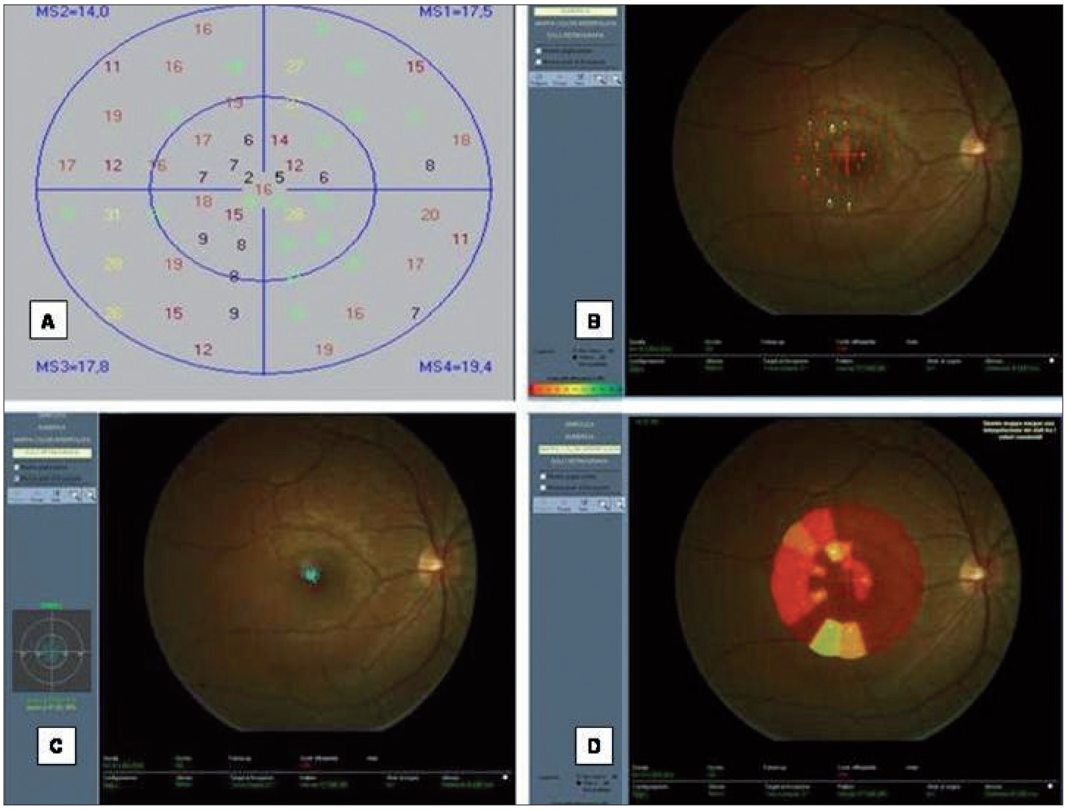

Fig. 1 - *Examinations at presentation: Octopus automated perimeter showed a significant diffuse reduction in mean light sensitivity, 15.38±8.1 dB* **(A)**. *MP-1 showed a dense scotoma within the central 12 degrees (0.28 ± 0.9 dB sensitivity), with the papillomacular bundle involvement* **(B, D)**. *The mean fixation stability was 91% considering 2° and 99% considering 4° around the fixation points* **(C)**.

a microperimetry of the retinal threshold sensitivity. This allows evaluation of the functional aspects of vision in direct association with the retinal morphology, also in case of patients with reduced visual acuity (4).

The purpose of this case report is to describe the efficacy of MP-1 in detecting early MS retinal lesions and in monitoring the effectiveness of treatment in terms of changes in macular sensitivity. The unique feature of this instrument is the tracking module, which guarantees stable fixation and reproducibility of measurements, therefore a liable follow-up.

Case report

A 21-year-old woman was referred to us complaining of recurrent episodes of eyesight loss in both eyes. Past medical history was significant for cephalea, fever, vertigo, nystagmus, and diagnosis of MS since 2004. She had never had visual field loss before.

At the time of our visit, neurologic examination revealed slight subjective paresthesia in the distal part of both legs with hypokinesia, Babinski sign present on the right side. Brain magnetic resonance imaging (MRI) revealed numerous hyperintense lesions in the periventricular and subcortical white matter. A spinal tap was performed and oligoclonal bands were detected in the cerebrospinal fluid. She was therefore diagnosed with MS.

At ophthalmologic examination, the best-corrected visual acuity was 20/25 bilaterally; ophthalmoscopy showed bilateral slight optic neuritis without swelling of the disc. All other ocular features were within normal limits.

Static perimetry of central visual field (30 degrees, by Octopus 101, Haag-Streit AG, Switzerland) and retinal sensitivity of the 12 central degrees (by MP-1 Micro Perimeter, Nidek Inc., Italy) were performed on the patient at that time.

In order to compare Octopus 101 and MP-1's light sensitivity, we referred to Springer et al (5). Twenty-one matching points in a rectangular test grid were considered, using similar examination settings with Goldmann III stimuli, stimulus presentation time of 100 msec, and white background illumination (1.27 cd/m^2). Octopus automated perimeter, which tests the central 30-degree field in a 6-degree grid, showed a significant diffuse reduction in mean light sensitivity (15.38±8.1 dB in the right eye and 27.66±3.3 dB in the left), with a higher central depression

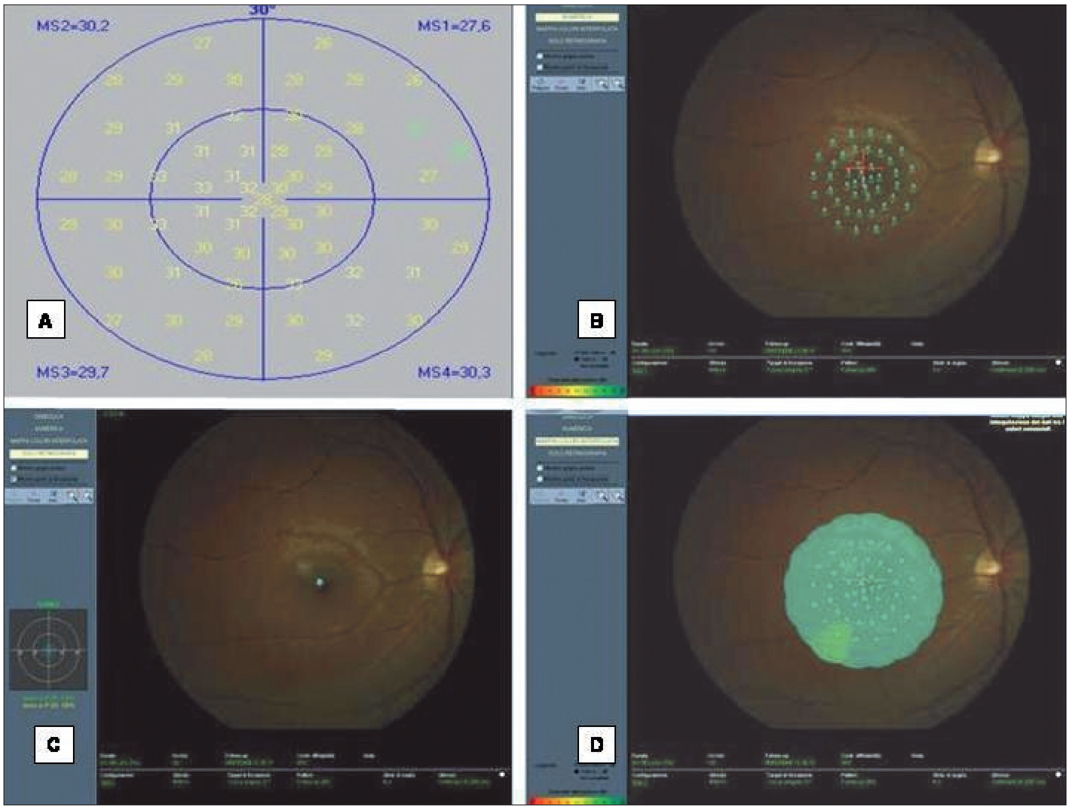

Fig. 2 - *Examinations after 8 days of therapy: Octopus automated perimeter showed a significant recovery in mean light sensitivity, 30.23±1.7 dB* **(A)**. *MP-1 also showed a significant recovery, with mean light sensitivity being 19.61±1.3 dB in both macular and peripapillary regions* **(B, D)**. *The mean fixation stability was 100% considering 2° and 100% considering 4° around the fixation points* **(C)**.

of 0–10 degrees (Fig. 1).

Prior to record values with MP-1, the subject was instructed to fixate the center of a red cross (3° in diameter) and fixation was tracked for 30 seconds. A series of three photographs of the fundus were also taken. In MP-1, thresholds to “white” stimuli (Goldmann III, 200 ms) are presented in an array subtending a radius of 6 deg, while the steadiness of fixation is controlled by the tracking system. Every 40 ms, the position of one retinal area is analyzed and quantified by the eye-tracker.

Fundus is imaged in real time by an infrared fundus camera and stimuli are controlled by dedicated software. Stimulus intensity may be varied on 1 (0.1 log) step scale from 0 to 20 dB, where 0 dB represents the brightest luminance of 400 asb (127 candles/square meter). Stimulus size may be varied by the examiner from I to V Goldmann standards. The fixation target, set at 100 asb, may be varied in size and shape according to the patient’s visual acuity and macular scotoma. A 4-2 staircase strategy is then carried out, and the last seen threshold value is taken as final threshold.

For this patient MP-1 showed a loss of sensitivity in the macular region: a dense scotoma within the central 12 degrees, with 0.28±0.9 dB sensitivity in the right eye and 19.42±1.5 dB in the left. In the right eye, the papillomacular bundle also was affected, with 0 dB of sensitivity (compared to 18 dB in the same area of the left eye) (Fig. 1D).

The fixation pattern considers two variables: fixation location and fixation stability. Fixation stability has been evaluated with MP-1 considering 2 and 4 degrees around the fixation point and correlated to retinography image. The mean fixation stability was 91% considering 2° and 99% considering 4° around the fixation points in the right eye, and 97% in 2° and 100% in 4° central degrees in the left (Fig. 1B).

In the weeks that followed vision continued to get worse in both eyes, so she underwent steroid therapy with methylprednisolone IV 1000 mg/day for 5 days and 500 mg/day for 3 days.

The patient was examined again at the end of the therapy. Octopus automated perimeter showed a significant recovery in mean light sensitivity (30.23±1.7 dB in the right eye and 30.95±1.8 dB in the left), without depression in the central 10° of the visual field (Fig. 2A). MP-1 also showed a significant recovery, with mean light sensitivity being 19.61±1.3 dB in the right eye and 20.0±0 dB in the left in both macular and peripapillary regions (Fig. 2, C and D). The mean fixation stability was 100% considering 2° and 100% considering 4° around the fixation points in both eyes (Fig. 2B).

DISCUSSION

Axonal loss, due to post-inflammatory lesions, is a common feature of MS, which causes a sudden decrease in visual acuity and visual field defects. This case report shows the efficacy of MP-1 in detecting early axonal damage as a loss in macular sensitivity, even before visual acuity decreases, in a more detailed way than conventional automated perimeter. It provides an accurate and reliable detection of small scotomic areas–in terms of their position, extension, and severity–which is a very useful tool especially in patients who present an associated optic neuritis. To our knowledge, optic neuritis is often the initial presentation of multiple sclerosis, characterized by a central defect in the visual field (6). Overall, MP-1 allows an accurate, automatic mapping of macular and peripapillary sensitivity, with a real-time correction of eye movements through its tracking system. Compared to Octopus 101 conventional static perimetry, it provides reproducible differential light threshold values with a systematic difference of 11.4 to 18.3 dB (5).

With regard to fixation control, fixation analysis and surveillance with MP-1 is far superior to Octopus' system, because eye movements are directly monitored and recorded.

In MP-1 findings, fixation is regarded as stable if more than 75% of the fixation points are inside the 2° diameter circle, as relatively unstable if less than 75% are inside the 2° diameter circle but more than 75% are inside the 4° diameter circle, and as unstable if less than 75% of the fixation points are inside the 4° diameter circle. In our patient, the mean fixation stability was 91% in the right eye and 97% in the left considering 2° and 100% in both eyes considering 4° around the fixation points.

In conclusion, the MP-1 can be an interesting tool for neuro-ophthalmologists as it allows a more precise evaluation of the macular and peripapillary region, which is not easily studied with conventional automated perimetry. Moreover, the association of fundus photography and tracking system permits us to focus on the area of interest and to test the exact same points at each follow-up.

In MS, the presence of a subclinical form of optic nerve involvement can be demonstrated in an early stage and well followed by the introduction of microperimeter testing in the standard examination protocol.

Proprietary interest: None.

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