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Spectralis High Magnification Module imaging in a case of Multiple Evanescent White Dot Syndrome

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ABSTRACT

Purpose: To report the use of Spectralis High Magnification Module (HMM) as part of multimodal imaging in Multiple Evanescent White Dot Syndrome (MEWDS).
Observations: HMM imaging showed a blurry mosaic pattern corresponding to MEWDS-related photoreceptors' lesions. These abnormalities remained detectable at later stages of the disease while other imaging modalities were negative.
Conclusions and importance: HMM can be a useful technique to monitor the structure of the outer retina during the different stages of MEWDS.

1. Introduction

Multiple evanescent white dot syndrome (MEWDS), first described in 1984 by Jampol et al. is a retinal disease, which presents in young, often myopic women with unilateral visual blurring and photopsia usually resolving spontaneously and completely in a few weeks.[1,2] The disease process was shown to reside in the retinal pigment epithelium (RPE) and/or the outer retina, while the choroid seem to be unaffected.[3,4]

The last few years have been marked by the outstanding contribution of multimodal imaging to the diagnosis and follow-up of patients with retinal dystrophies and retinal inflammatory diseases. Most widely used techniques to examine the retinal structure include Spectral Domain – Optical Coherence Tomography (SD-OCT) with B-scan (OCT-B) or en face (OCT-C) acquisitions, and possibly coupled with angiography (OCT-A). More recently, adaptive optics has emerged as an ultrahigh-resolution technology providing very fine histologic images of the retina at a scale where individual cells are visible. It is regarded, to date, as the best in vivo imaging of human cone photoreceptors. Image acquisition is made by the means of a dedicated device different from OCT. It relies upon the reflection of light back to the instrument by cone outer segments. Visualization of photoreceptors is dependent on intact outer segment morphology and only healthy photoreceptors appear as a mosaic of bright spots.[5]

Albeit it is worthwhile to have the best evaluation of the photoreceptors' health, it appears important and practical in current clinical practice to use the same device for all the imaging required in the evaluation of retinal pathology. Heidelberg Engineering has recently introduced the Spectralis High Magnification Module (HMM), which is a lens attachment for the company's Spectralis confocal scanning laser ophthalmoscope, a multimodal imaging platform optimized for the posterior segment. It allows the same commonly used device to capture images of higher resolution without the need for pupillary dilation; its objective lens magnifies the fundus to provide a field of view of about 8°, designed to improve the visualization of microscopic fundus details. The HMM module allows to identify a region of interest within the standard field of view and then acquire magnified images at an enhanced resolution to investigate the microstructure of these regions. This technology not only offers documentation of clinical findings but also often highlights critical diagnostic details not visible on traditional clinical ophthalmoscopy.

We hereby report the application of HMM in the case of a patient with MEWDS, in addition to a classical multimodal imaging evaluation.

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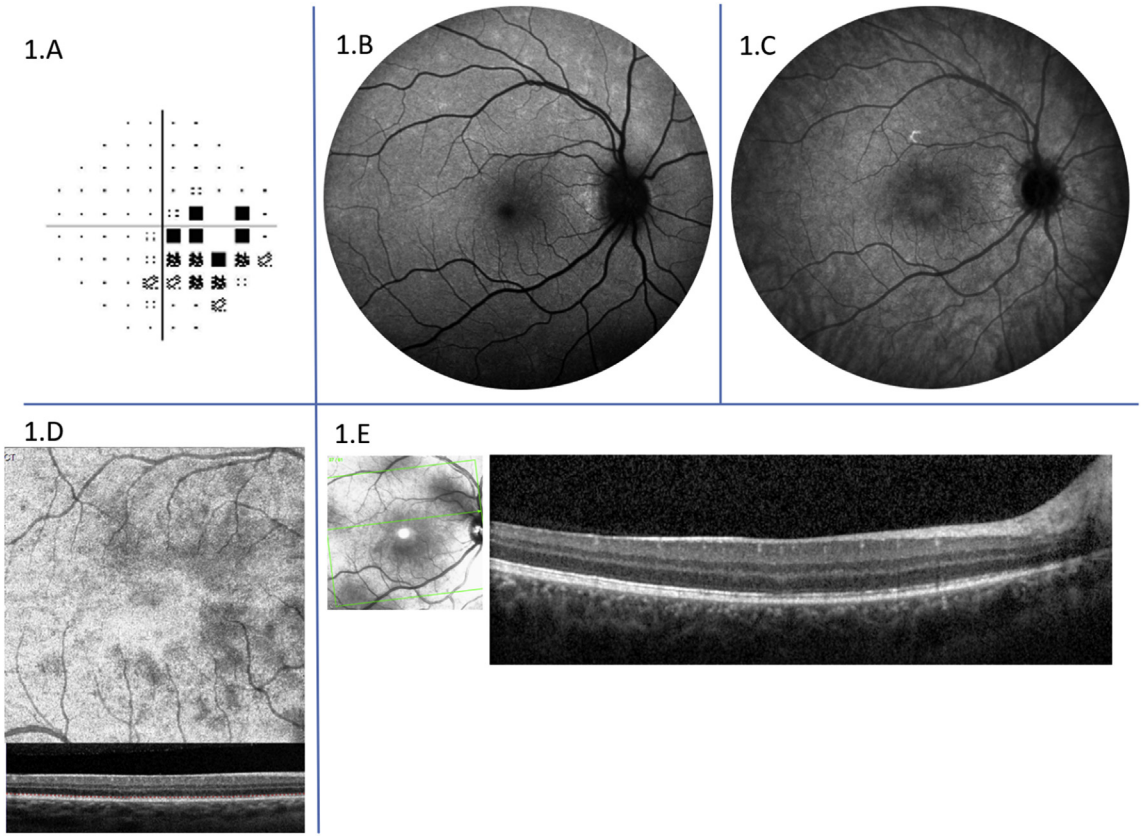

Fig. 1. Right eye at baseline; 1.A: Visual Field central 30-2 showing an enlargement of the blind spot; 1.B: hyperautofluorescent dots in the superior and supero-temporal periphery and at the temporal margin of the optic disc; 1.C: Late-phase indocyanine green angiogram showing a sharp hypofluorescent ring around the optic disc and large hypofluorescent retinal areas all around the fovea; 1.D&E: C- and B-scans respectively showing ellipsoid alterations. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

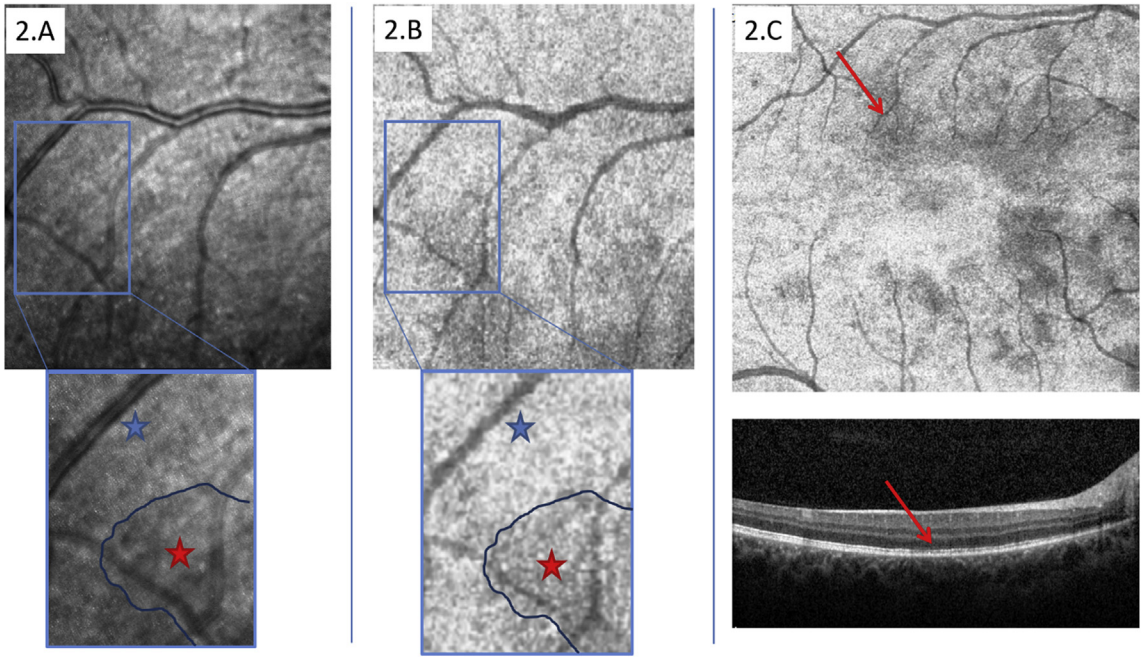

Fig. 2. MEWDS-related anomalies seen with HMM and OCT. The area limited by a black line and marked with a red star appears blurry on HMM and may reflect a pathologic photoreceptor mosaic (2.A); its hyporeflectivity on C-scan (2.B) corresponds with an ellipsoid alteration as pointed by the red arrows (2.C). Blue stars indicate unaffected regions with an apparently intact photoreceptor mosaic. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article).

2. Case report

A 30-year-old woman was referred to our department from the Neuro-ophthalmology division of the Rothschild Foundation Hospital (Paris, France) for the evaluation and the workup of a MEWDS in her right eye. She complained of intermittent photopsia described as a dazzling sensation of light with numerous dark spots that were predominant in the temporal visual field of the affected eye. The patient stated that her symptoms started one month earlier after that she fell to the ground without losing consciousness. Since then, the symptoms persisted despite a slight improvement. Magnetic Resonance Imaging (MRI) was normal and ophthalmic examination was within normal limits: visual acuity was 20/20 and intraocular pressure was 12 mmHg in both eyes. No signs of inflammation were noted in both anterior and posterior segments.

Humphrey visual field central 30-2 threshold testing showed an enlarged blind spot in the right eye, whereas the left eye was normal *(Fig. 1A)*. Fundus examination didn't show any particularity, but fundus autofluorescence (FAF) revealed hyperautofluorescent dots in the superior and supero-temporal periphery and at the temporal margin of the optic disc *(Fig. 1B)*. OCT B and C scans were also contributive, demonstrating multiple hyporeflective lesions around the fovea and large areas of ellipsoid alterations *(Fig. 1D&E)*. The diagnosis of MEWDS in the right eye was confirmed by indocyanine green (ICG) angiography with the late phase showing a sharp hypofluorescent ring around the optic disc and large hypofluorescent retinal areas all around the fovea *(Fig. 1C)*. No anomalies were detected in the left eye on all examinations. HMM imaging showed a mosaic pattern of photoreceptor with bright spots in some areas; some patches looked relatively darker and blurred and corresponded with areas of hyporeflectivity on OCT-C and ellipsoid alteration on OCT-B *(Fig. 2)*.

Two months later, the patient noted that her visual blur improved, but still had intermittent photopsia. OCT-B and C showed a clear improvement of the ellipsoid zone with a reappearance of the regular photoreceptor mosaic on HMM *(Fig. 3)*. Fig. 4 shows that despite a rough normalization of FAF at 2 months, HMM could still reveal some persistent abnormalities of the photoreceptor mosaic. Fig. 5 was added for comparison purposes as an example of a normal photoreceptor mosaic pattern on HMM imaging of a healthy eye.

3. Discussion

MEWDS is a disease of the retina featuring multiple white spots and dots that mostly reflect a disruption of the ellipsoid zone where outer segments of the photoreceptors are located. During the acute phase of the disorder, new dots and spots appear in a cluster as older lesions disappear, with spots resolving before dots. Dots and spots correspond to lesions in the deep retina and RPE and contribute, along with peripapillary hypofluorescence, to a pathognomonic pattern on ICGA.[6]

HMM is a recent upgrade on the confocal scanning laser ophthalmoscope integrated in Spectralis that offers near-infrared imaging modes. It doubles the focal length compared with the Spectralis standard 30° objective and expands the imaging beam diameter to about 5 mm, which improves the system's diffraction-limited lateral optical resolution in the eye. However, imperfections in the ocular optics cause optical aberrations which degrade this optical resolution. The device is not equipped with adaptive optics to reduce these aberrations; the amount of discernible detail therefore strongly depends on the quality of the patient's ocular optics. Thus, to optimize the amount of discernible fundus details, we attempted to minimize the pupil size to about 1.5 mm. Importantly, HMM also increases the digital resolution compared with the standard objective, to a pixel spacing of images of about 1.5 μm, which helps to visualize more details.

To the best of our knowledge, this is the first presentation of HMM imaging in a patient with MEWDS. This patient was referred to us after an evolution of one month and at this time of the disease, fundus biomicroscopy appeared normal. Nevertheless, FAF still showed areas of hyperautofluorescence. OCT-B revealed a disruption of the ellipsoid zone, that matched with hyporeflective areas on OCT-C. Usually, in these cases, adaptive optics data confirm these findings, as they show large “loss” of central photoreceptor density during a MEWDS episode.[7] Conversely, Onishi et al. used adaptive optics to report hyperreflective deposits at the level of the RPE, corresponding to the “dots” and underlying an intact photoreceptor mosaic.[8] Yet, our case is an additional proof that photoreceptors are, in fact, a true location of MEWDS lesions, possibly secondary to RPE involvement, and most importantly, reversible with time. This statement is supported by the changes in the photoreceptor mosaic observed with HMM imaging. The latter

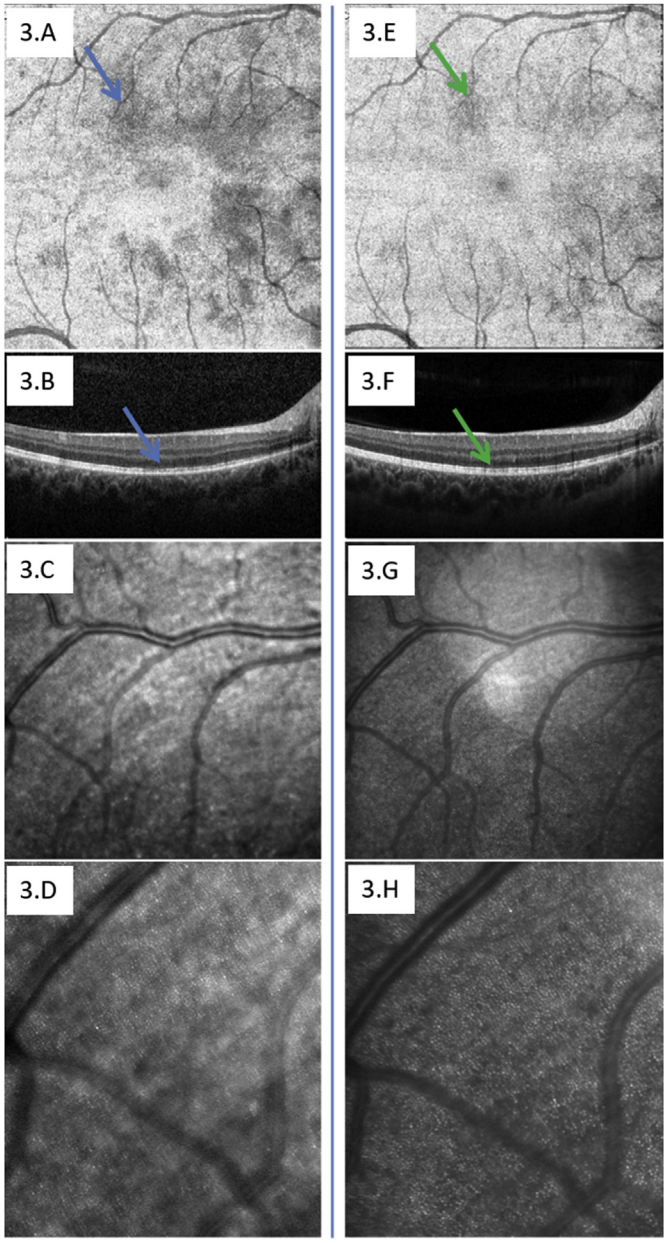

Fig. 3. Evolution of the lesions after 2 months; Left column (baseline) from top to bottom: blue arrows indicating hyporeflective lesions surrounding the fovea corresponding to large areas of ellipsoid alteration on OCT C-scan (3.A) and B-scan (3.B), blurry photoreceptor mosaic on HMM (3.C&D); Right column (2 months later): green arrows showing improvement of the ellipsoid on OCT C-scan (3.E) and B-scan (3.F) with a photoreceptor mosaic returning to normal on HMM (3.G&H). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article).

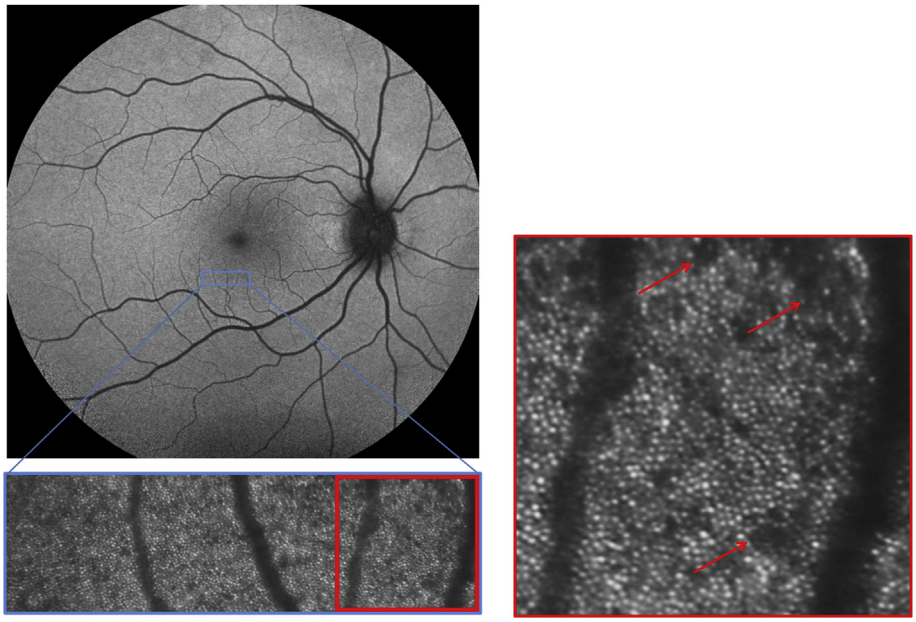

Fig. 4. At 2 months following presentation, hyperautofluorecent dots disappeared; however, magnification of HMM images allowed to visualize irregularities of the photoreceptor mosaic (red arrows). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article).

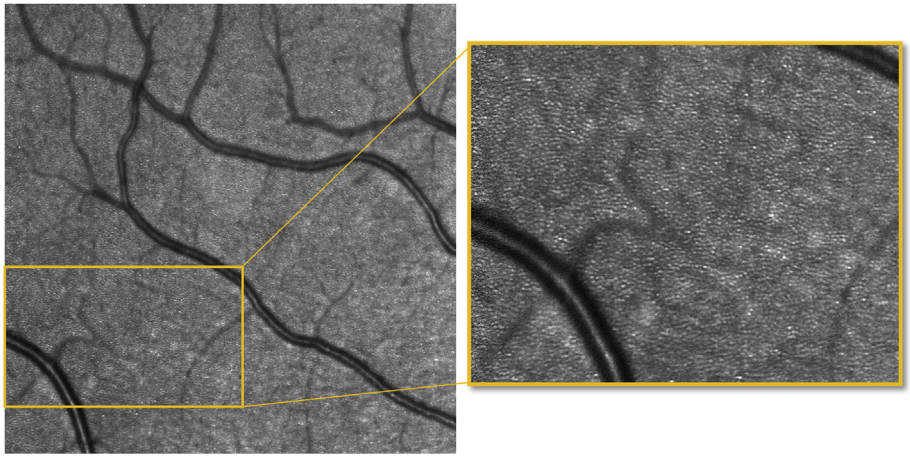

Fig. 5. HMM imaging of a healthy eye showing a normal photoreceptor mosaic pattern, magnified in a yellow rectangle. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article).

technology provided a non-invasive visualization of MEWDS lesions at the level of photoreceptors, in concomitance with OCT signs, using a single imaging device. HMM appeared to be useful not only at the active phase MEWDS, but also during the process of healing, where it continued to show, until at least 2 months, discrete signs that can be unnoticed with other imaging modalities such as FAF.

4. Conclusions

HHM is a new technology falling within the advances in multimodal imaging. It has the advantage of being installed on a preexisting and familiar platform, which should not require a long learning curve. This democratizes the study of photoreceptors and makes from HMM an accessible alternative for adaptive optics, because it allows in vivo visualization of the photoreceptor mosaic without pupil dilation, and better understanding of the outer retinal pathophysiology, during different stages of a disease and through the healing process as well. Further studies are required to verify the reproducibility of HMM and explore its application in other diseases.

4.1. Patient consent

Consent to publish this case report has been obtained from the patient(s) in writing.

Declaration of competing interest

The following authors have no financial disclosures: VV, NA, ASA, JL, MP, CCV, MMF.

Authorship: All authors attest that they meet the current ICMJE criteria for Authorship.

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