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Multimodal imaging of regressing drusen

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Purpose: To investigate the multimodal characteristics of calcific regressing drusen.

Methods: Consecutive patients with calcific regressing drusen underwent multimodal assessment including confocal scanning laser ophthalmoscope infrared reflectance (IR),MultiColor imaging, "eye-tracked" spectral- domain optical coherence tomography (SD-OCT) and en face Adaptive Optics (AO).

Results: Thirty eyes form 23 consecutive patients (8 male, 15 female, mean age 82.7 years ± 10.1 years) with calcific regressing drusen were included for analysis. On SD-OCT calcific regressing drusen appeared as a laminar/multilaminar intense hyperreflectivity with different degrees of fragmentation. The multilaminar hypereflectivity was found to localize to beneath the retinal pigment epithelium (RPE) and above the outer Bruch membrane layer (oBM). The SD-OCT analysis allowed describing 3 different types of sub-RPE hypereflectivities. "Type 1" laminar/multilaminar hypereflectivity (12 of 30 eyes) was characterized by an intense signal originating from what we interpreted as the inner Bruch membrane (iBM) layer. "Type 2" multilaminar hypereflectivity (27 of 30 eyes) was characterized by an intense signal originating from the oBM layer. "Type 3" multilaminar fragmented hypereflectivity (11 of 30 eyes) was characterized by an intense signal originating from what we interpreted as both the iBM and oBM, showing different degrees of fragmentation.

In 9 of 30 eyes with calcific regressing drusen, en face AO IR imaging showed fused round or pisciform highly refractile lesion in correspondence of spectral domain optical coherence tomography featured laminar/multilaminar sub-RPE intense hyperreflectivity.

Interestingly, in 7 further eyes clinically diagnosed with regressing drusen, en face AO IR imaging revealed highly refractile interspersed tiny dots rather than round or pisciform highly refractile lesion. In those eyes, the corresponding SD-OCT scans showed absence of laminar/multilaminar sub-RPE intense hypereflectivity.

Discusssion: The stratified multilaminar sub-RPE intense hypereflectivity here described by SD-OCT in eyes clinically diagnosed with regressing drusen could be interpreted as the in vivo visualization of calcific coiled (not removed) membranous debris. Layers of lipid mineralization (in part similar to atherosclerotic changes) may develop internal Sub-RPE hypereflectivity in regressing drusen and external to the basement membrane, in the form of "Type 1" and "Type 2" multilaminar hypereflectivity (originating from the iBM and oBM SD-OCT layers), respectively. "Type 3" multilaminar fragmented hypereflectivities (originating from both the iBM and oBM SD-OCT layers) may correspond to fractures in the Bruch membrane, which develop subsequently to calcification, and could lead to neovascularization.

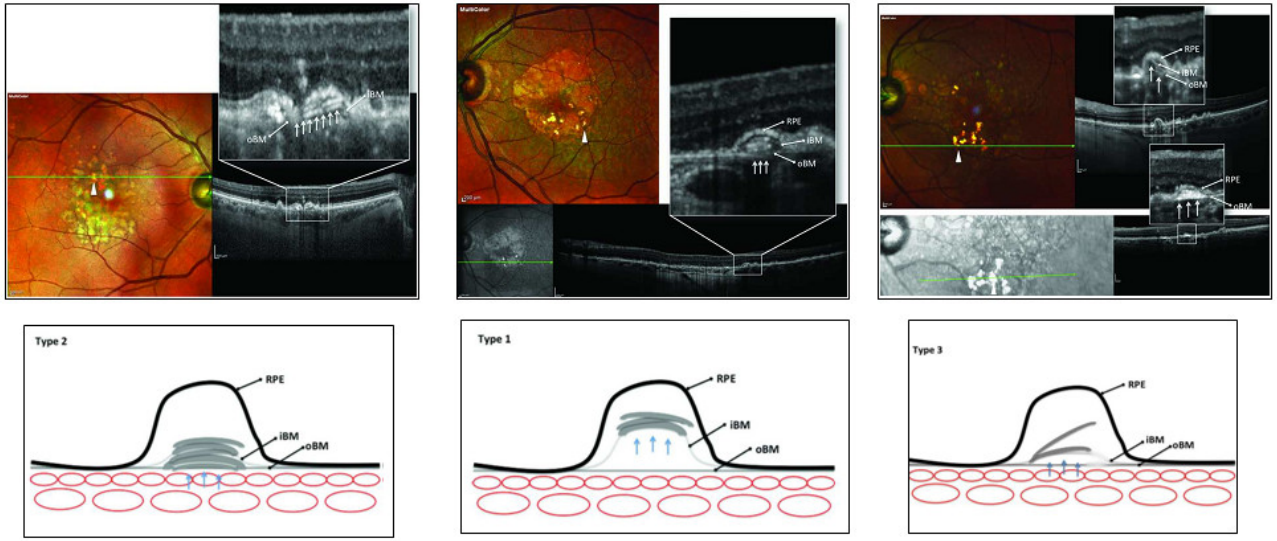
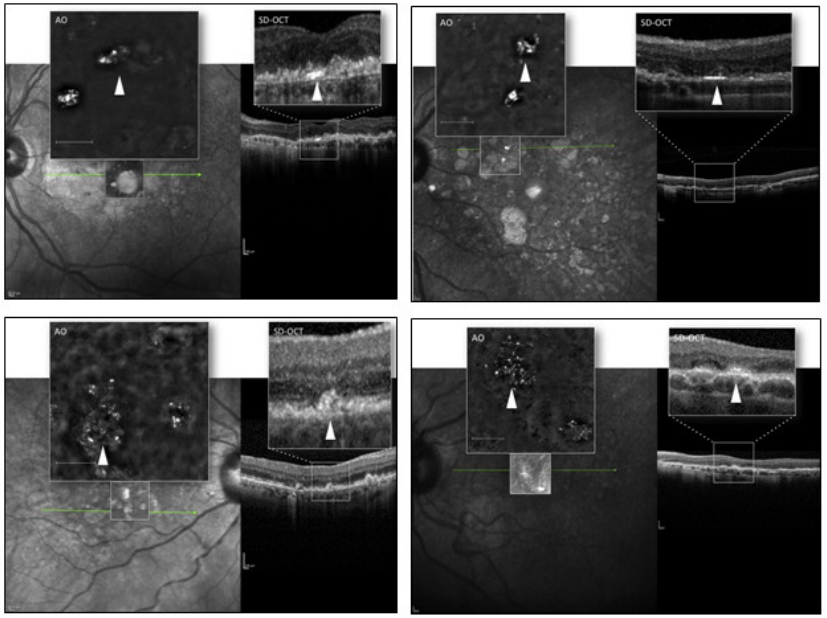


Figure 1. A,B and C:

A.Combined MultiColor® Image and spectral-domain (SD-OCT) scan of "type 1" multilaminar hyperreflectivity in a patient with nonexudative age- related macular degeneration.

B. MultiColor® Image, and combined Infrared reflectance (IR) image and spectral-domain(SD-OCT) scan of "type 2" multilaminar hyperreflectivity in a patient with nonexudative age-related macular degeneration.

C. Combined MultiColor® Image, Infrared reflectance (IR) image and spectral-domain(SD-OCT) scan of "type 2" and "type 3" multilaminar hyperreflectivity in a patient with nonexudative age-related macular degeneration.



En face confocal scanning laser ophthalmoscope (SLO) infrared (IR) and adaptive optics (AO) imaging in an 83-year-old woman (**A**) and in a 69-year-old woman (**B**) with regressing drusen characterized by slightly reflective tiny lesions on spectral-domain optical coherence tomography (SD-OCT). Imaging in an 83-year-old man (**C**) and in an 86-year-old woman (**D**) with regressing drusen characterized by absence of laminar/multilaminar sub-retinal pigment epithelium intense hyperreflectivity SD-OCT.

Conclusion:

Multimodal imaging allows to distinguish different characteristic of regressing drusen, possibly representing different stages in drusen calcification and regression.

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