

# Adaptive Optics enhances imaging in Age-related Macular Degeneration

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## Purpose

To characterize the aspect of Age-related Macular Degeneration (AMD), Geographic Atrophy (GA), and age-related and familial drusen at the microscopic scale using Adaptive Optics (AO).

## Methods

The study included 5 cases of GA, 4 cases of early stage AMD with age-related drusen and 2 cases of familial drusen. The patients underwent high-resolution spectral-domain Optical Coherence Tomography (OCT) and Scanning Laser Ophthalmoscopy (SLO) examinations (performed with Spectralis HRA+OCT, Heidelberg, Germany).

Then, the same eyes were analyzed using an AO retinal camera (rtx1, Imagine Eyes, Orsay, France, Fig. 1.) at eccentricity ranging from 0 deg to 4 deg from the foveola. The resulting AO images were registered with the corresponding OCT and SLO images.



Fig. 1. Adaptive Optics retinal camera rtx1<sup>tm</sup> used for the study.

## Results

In AO images, most drusen appeared as doughnut-shaped highly reflective zones. AO instrument provided detailed images of very small familial drusen, that were barely detectable using SLO and OCT. The overlying cone mosaic was visible in all drusen AO images, yet it exhibited local losses in cell visibility in several areas. The comparison with matched OCT data showed that areas with reduced cone visibility were mostly located over the drusen slopes. Cones were almost always visible at the top of drusen. In the flat retinal areas that surrounded drusen, the cones were organized in normal mosaic patterns. In GA cases, AO images revealed

irregular patches of multiple cone-like bright spots as well as larger dark disks in atrophic areas. Such structures were not visible in the areas bordering the atrophic zone.

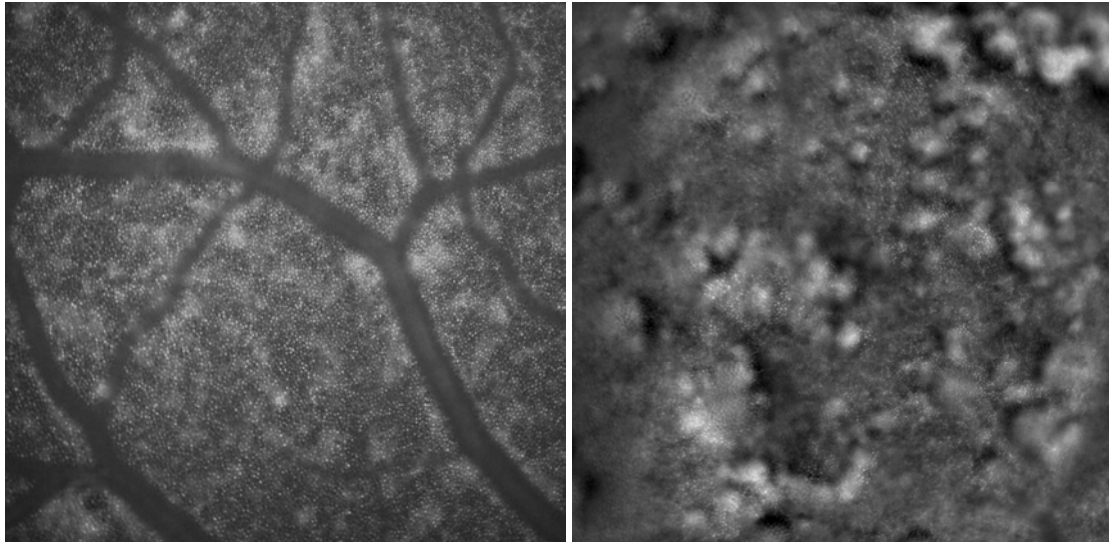


Fig. 2. Cone mosaic observed with Adaptive Optics. Healthy retina of a 37 year old subject, Right eye, field  $3^\circ \times 3^\circ$ , centered a  $2^\circ$  Nasal,  $4^\circ$  inferior (left) Retina with familial drusen of a 25 year old subject, Right eye, field  $3^\circ \times 3^\circ$ , centered a  $4^\circ$  Temporal (right).

## Conclusions

AO provided images of microscopic structures in various types of AMD, including GA. The regularity of the cone mosaic observed over the top of and between drusen suggested that the presence of drusen might have limited impact on cone metabolism. Local losses in cone contrast at the drusen slopes confirmed a strong relation between cone visibility and their orientation. The observation of GA AO images suggested that cones were present in atrophic areas, though their spatial distribution was irregular. These results lead us to anticipate that the AO retinal camera will be a powerful tool for quantifying spontaneous or therapeutic changes in AMD patients.

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