Clinical research with the rtx1™ Adaptive Optics retinal camera

Summary of published results in **age-related macular degeneration**

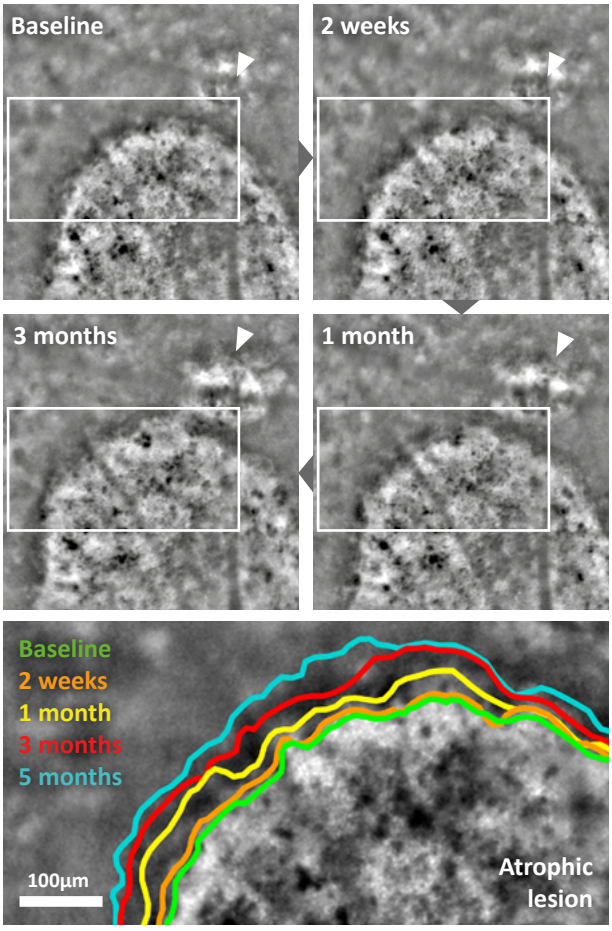
Dry AMD is the most common type of AMD, accounting for 90% of diagnosed cases. In this form of the disease, the breakdown of macular cells results in growing areas of geographic atrophy (GA). However, the progression is very slow and its detection usually takes months.

Thanks to Adaptive Optics (AO) technology, rtx1™ enabled visualizing retinal changes in AMD patients at the cellular level. Moreover, since rtx1 images are distortion-free, follow-up images could be aligned with high precision to study the dynamics of such changes over shorter time scales.

Clinical studies using rtx1 have resulted in new findings:

- In the early stages of AMD, conventional drusen and reticular pseudodrusen were characterized by different reflectivity profiles on rtx1 images[1–3]. A gaze-dependent procedure using rtx1 enabled increasing the detection of small drusen by up to 250% compared with color-fundus image analysis[4].
- On eyes with dry AMD, GA borders and spared foveal areas appeared more detailed on rtx1 images than on SLO and autofluorescence (AF) images[5,6]. Time-lapse rtx1 imaging enabled tracking displacements of GA borders with micrometer precision, and detecting progression in less than 1 month[5].
- The rtx1 also revealed a new candidate biomarker for dry AMD: the hyporeflective clumps (HRCs) which accumulate and migrate during disease progression. Although HRCs are invisible with other imaging techniques, the rtx1 enabled to observe their motion within a few days[1,5].
- Two clinical investigations of stem-cell therapies for exsudative AMD have used rtx1. It helped assessing the survival of cone cells[7] in one investigation, and of the implanted RPE cells[8] in the other.

> *The current technological level of robustness and the possibility to obtain quantitative biomarkers already permits the integration of AO in large scale trials in AMD.*
>
> Paques et al., *Progress in Retina and Eye Research*, 2018

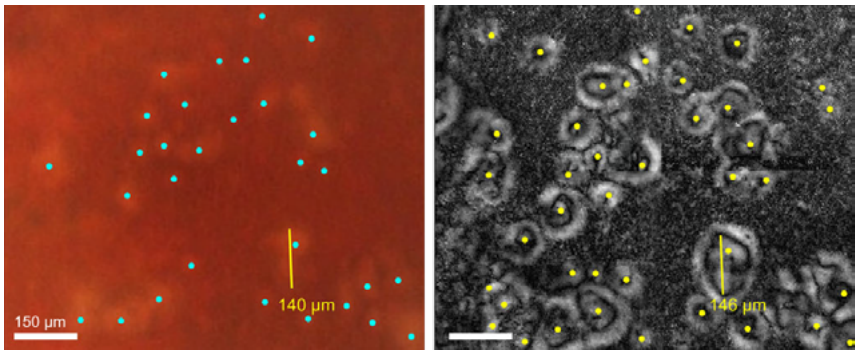


GA border progression monitored over short time with the rtx1. A nascent GA (arrowhead) is also visibly growing.

Credit: Quinze-Vingts National Eye Hospital, Paris

Small drusen assessment. The result of gaze-dependent AO imaging wth rtx1 (right) reveals more drusen than the color image of the same area (right).

Credit: Rossi et al. TVST, 2021



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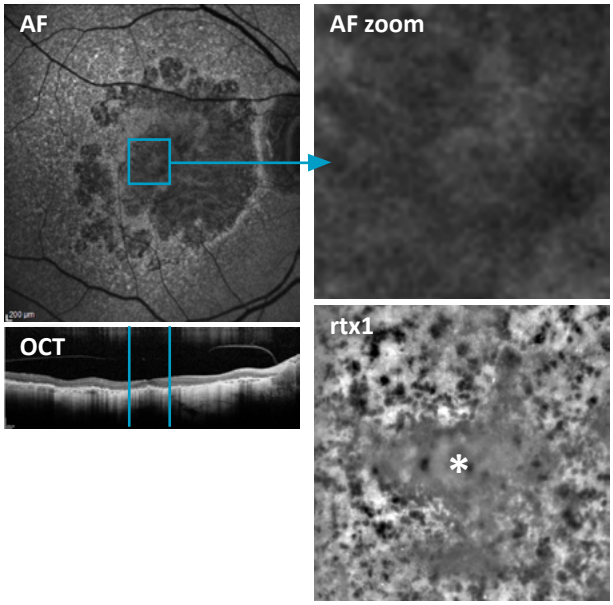
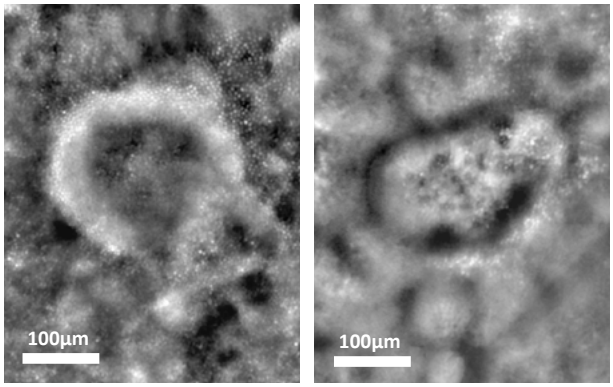
> *Preservation of functional cone photoreceptors could be demonstrated on en face AO images in areas of foveal sparing that highlights the utility of this imaging modality in the evaluation of emerging treatments for GA.*
>
> Querques et al., Retina, 2016



Multimodal imaging of foveal sparing in a dry AMD case. Compared with the AF image, the rtx1 image shows the spared area (*) more sharply and reveals HRCs in the arophic area (dark dots). Credit: Quinze-VIngts National Eye Hospital, Paris

> *Migration of HRCs is a highly dynamic process in AMD; it can indeed be detected over a timescale of days while atrophy progression is only detectable over a timescale of weeks.*
>
> Paques et al., Progress in Retina and Eye Research, 2018



rtx1 images of conventional drusen (left) with hyperreflective rings, and of pseudodrusen (right) with hyporeflective rings. Credit: Quinze-VIngts National Eye Hospital, Paris

> *The rtx1 allowed us to directly observe stem cell-derived RPE cells after their transplantation in a patient's retina. Thanks to the rtx1's microscopic resolution, we could verify that the mosaic arrangement of these cells was similar to that of natural RPE cells, and stable over time.*
>
> Dr. Seiji Takagi, Kobe City Eye Hispital, Japan, 2019

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