Clinical research with the **rtx1™** Adaptive Optics Retinal Camera

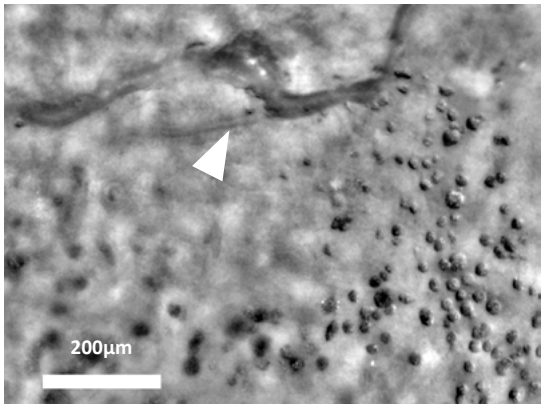
Summary of published results in **Diabetic Retinopathy**

The detection of early damage to organs is of key importance in the management of diabetes.

The rtx1™, thanks to adaptive optics (AO) technology, has enabled visualizing multiple early alterations caused by diabetes to the retina, often before any damage is visible using other retinal imaging techniques.

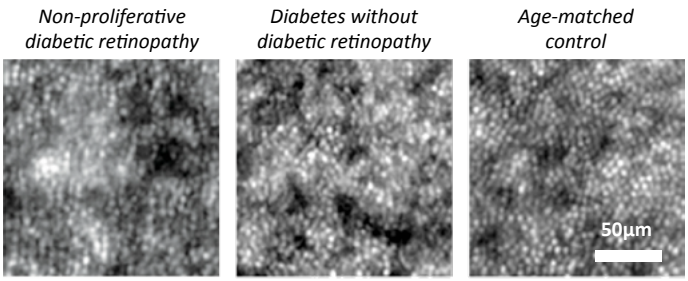
Clinical studies using the rtx1 AO retinal camera in diabetes have resulted in the following findings:

- rtx1 images revealed microscopic hemorrhages[1–4], non-flowing blood cells[1], edematous cyst walls[1,4], structural details of hard exudates[1,3-5], and arteriolar wall structure[6–9]
- Microaneurisms could be visualized without injecting any contrast agent[3,4]
- The rtx1 enabled assessing retinal microvascular structure[6–10] and cone cell mosaic[2,7,8,11–14] using metrics.
- In diabetic patients, rtx1 publications reported modifications in capillary diameter[10], in artery wall thickness and lumen diameter[7–9], as well as in cone density[2,8,11–14] and regularity[8]
- Such microscopic signs of pathology were observed not only in diabetic retinopathy (DR)[1–5,8,10,11,14], but also at earlier stages, including diabetes without DR[2,6,9,11–14] and possibly pre-diabetic conditions[7]



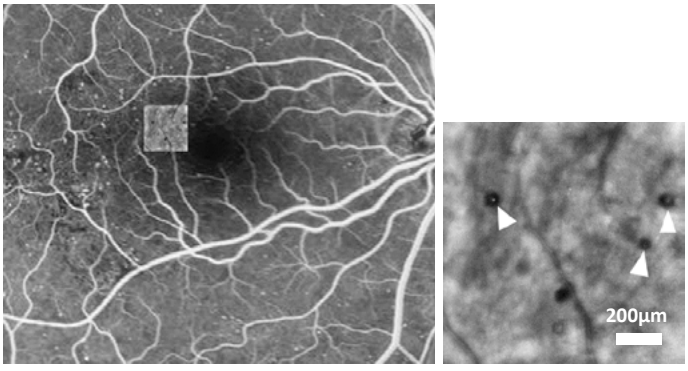
Aneurism (arrowhead) and hard exudate (spots) on rtx1 image. Credit: Quinze-Vingts National Eye Hospital, Paris

> *AO imaging may potentially assist in detecting diabetic retinopathy at an earlier stage, may help elucidating the pathophysiology of the diseases and may be used for evaluating the effects of clinical interventions on diabetic retinopathy*
>
> Bek et al. *Acta Ophthalmologica*, 2014



Changes in photoreceptor visibility revealed by the rtx1 in diabetic patients compared to age-matched control. Credit: Lombardo et al. 2016

> *Detection of photoreceptor loss at early stages of DR [...] may contribute to changing the current standard regimen of treatment via earlier intervention to stop further damage.*
>
> Soliman et al. *PLOS ONE*, 2016



Left: Fluorescein angiography image in a case of diabetic retinopathy. Overlay: Microaneurisms (arrows) imaged without contrast agent with the rtx1. Credit: Quinze-Vingts National Eye Hospital, Paris

> *[...] an exquisitely fine documentation of microscopic features such as microaneurysms, microhemorrages, and hard exudates can also be obtained with [adaptive optics ophthalmoscopy]*
>
> Paques et al. *Prog in Retina and Eye Res*, 2018

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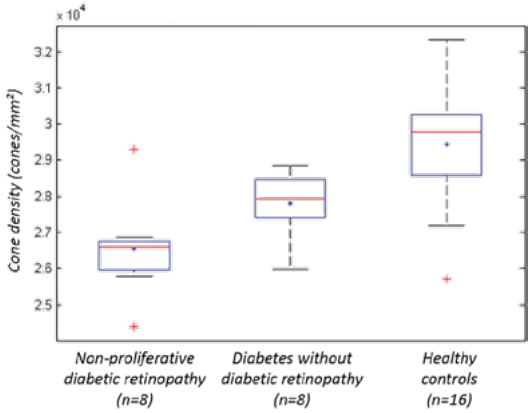

Box plot showing the distribution of values for cone density measured on rtx1 images, at 1.5 degrees eccentric from the fovea, in diabetic patients and age-matched controls. Credit: Lombardo et al. 2016

> *Our findings indicate that parafoveal cone density decreased by a mean (± SD) of 1672 ± 2859 cones/mm² per step of DR progression.*
>
> Soliman et al. *PLOS ONE*, 2016

> *Diabetic hard exudate changes occurred over a short period of time but were not assessable clinically. Adaptive optics was able to document these subtle changes precisely.*
>
> Loganadane et al. *Opthalmic Research*, 2018

> *The retinal image analysis with rtx1 offers a novel noninvasive measurement of early changes in the vasculature that are not detectable on routine clinical examination. This measurement may allow the identification of individuals at risk of diabetes [...].*
>
> Zaleska-Zmijewska et al. *Journal of Diabetes Research*, 2017

> *AOO non-invasively identifies retinal structural changes in human confirming that microvascular remodeling is exclusively related to hypertension, whereas vascular growth is related to ageing and hyperglycaemia.*
>
> Gallo et al. *Clinical Research in Cardiology*, 2020

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imagine eyes®
www.imagine-eyes.com

18 rue Charles de Gaulle
91400 Orsay, FRANCE
+33 (0) 1 64 86 15 66
contact@imagine-eyes.com