Deep Range Imaging Optical Coherence Tomography (DRI-OCT): A New Imaging Modality of the Cortical Vitreous, the Neuroretina and the Choroid

Optical Coherence Tomography (OCT) imaging is a must have tool in a retina clinic for the evaluation of patients suffering from a vitreoretinal, retino-choroidal or uveitic condition.

Advances in pharmacological treatments of vitreoretinal diseases have increased the interest in this imaging modality and allowed for significant investment by manufacturers and users in this ever improving technology.

We have also seen a significant improvement in image quality with the change form time to spectral-domain OCT, which has perhaps reduced the number of fundus fluorescein angiograms being requested. Not only has the treating physician welcomed the 2 and 3D visualization of some of the intraocular structures but also patients have welcomed this relatively fast, non-invasive and risk-free method of examination.

OCT is essential for the diagnosis, follow-up and treatment decisions of patients suffering from conditions affecting the vitreoretinal interface such as vitreo-macular adhesion or traction, epiretinal membrane, macular hole and conditions affecting the neuroretina and choroid such as diabetic macular oedema (DMO), age-related macular degeneration (AMD), polypoidal choroidopathy, central serous retinopathy and branch and central retinal vein occlusion, amongst others. OCT has also demonstrated the possible role of vitreo-retinal adhesions and perhaps traction in an increasing number of conditions, such as high myopia, where loss of vision was previously only attributed to retinochoroidal changes.

Imaging the presence of intra or subretinal fluid can nowadays be easily achieved with most OCT systems. However, imaging the cortical vitreous and the full-thickness of the choroid is technically challenging.

Vitreomacular adhesion (VMA) occurs with incomplete separation of the posterior vitreous body at the macula and this could be the beginning of a disease spectrum that can lead to for example, macular hole.1,2,3 The advent of OCT has allowed for an easier and accurate identification of VMA and a better understanding of

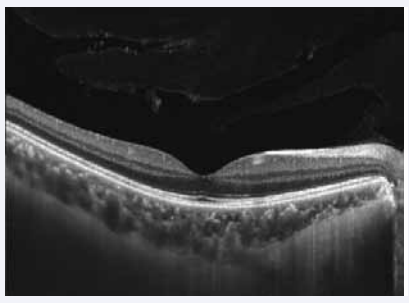

Figure 1. Cortical Vitreous DRI-OCT imaging

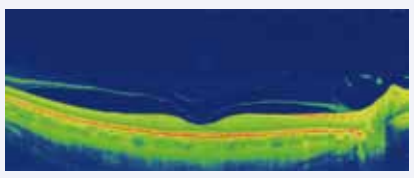

Figure 3. Bursa Premacularis with VMA

pathology at the vitreoretinal interface (VRI). Symptomatic VMA is the association of metamorphopsia with or without deterioration of visual acuity with VMA.1,4,5,6 VMA can lead to vitreomacular traction (VMT).1,7,8 VMT can be caused by an abnormally persistent VMA following vitreous separation or contraction of the perifoveal vitreous cortex following cell proliferation.7,8 Complete vitreomacular separation infrequently occurs in patients with VMT. In a retrospective study, 11% of eyes with VMT underwent complete PVD. Most symptomatic eyes with VMT undergo further decrease in visual acuity. 9 Because unresolved VMA may have a role in the pathophysiology of several chorioretinal disorders, including amongst others DMO and AMD, and also because symptomatic VMA and VMT can now be treated not only surgically but pharmacologically in a percentage of patients it is therefore very important to be able to diagnose it as its resolution can lead to an improvement in vision. 7,10,11,12

The new Topcon® Deep Range Imaging OCT (DRI-OCT®) has a scanning speed of 100,000 A-scans/sec and is based on Swept-Source technology utilizing a wavelength of 1,050nm.

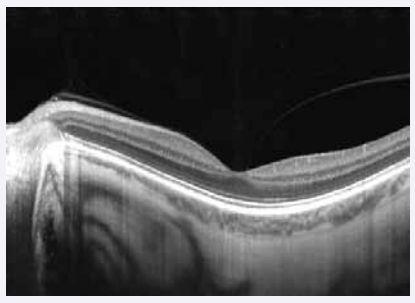

Figure 2. Bursa Premacularis with VMA

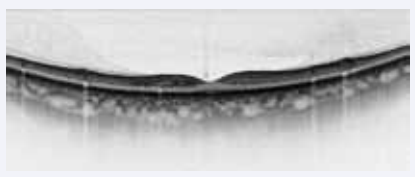

Figure 4. Choroidal imaging with DRI-OCT

The use of near infra-red wavelength combined with high speed of scanning allows for improved visualization of the cortical vitreous with less light scattering by an almost transparent media that is flowing and not stable over time. DRI-OCT is less sensitive than conventional Spectral-Domain OCT to sample motion.

The retinal pigment epithelium (RPE) is a high-scattering retinal layer that significantly attenuates the OCT signal passing through it thus reducing the information arising from the choroid. This is the main reason why the currently on the market 800-nm wavelength OCT scanners are not suitable for imaging structures posterior to it. DRI-OCT allows for higher penetration through the RPE thus enabling deep and full-thickness choroidal imaging up to even the scleral surface. One of the main difficulties in measuring choroidal thickness is that conventional OCT scanners are not capable of reliably showing the scleral surface and therefore the posterior limit of the choroidal layer.

The use of invisible longer wavelength also contributes to reduced eye motion which allows for more accurate scanning with less registration artifacts.

DRI-OCT allows for 12mm wide scans which provide increased coverage including the macular area and the disc in a single scan. The wide longitudinal imaging range allows for the visualization of the vitreous up to the chorioscleral interface in the same image with almost uniform signal sensitivity.

With a significant number of therapies being delivered via intravitreal injections it is getting increasingly important to being able to image anatomical changes in-vivo not only at the level of the vitreoretinal interface but also in the cortical vitreous as well as changes in choroidal thickness and vascularity and understand their role in disease.

Disclaimer:

DRI-OCT is a new imaging device manufactured by Topcon Corporation, Japan.

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PES Financial Disclosure:
Allergan Plc.
Bausch & Lomb Inc.
Bayer AG
Optos Plc.
Thrombogenics Inc.
Topcon Corp.

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