Look inside:

Optical Coherence Tomography
A Clinical Atlas of Retinal Images

By Darrin A. Landry, CRA, OCT-C

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Zeiss Cirrus
Zeiss Stratus
Heidelberg Spectralis
Optovue RTVue
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I. Atlas of Images

The retina is a complex, multilayer structure that is responsible for receiving light and converting it to neural impulses, which are interpreted by the brain. The central area of the retina, which is where the concentration of ganglion cells are located, is called the macula. It is about 5.5mm in diameter, and is within the superior and inferior vascular arcades. The anatomic fovea, which is a central depression in the center of the macula, is only about 1.5mm in diameter, approximately the same size as the optic disc. The anatomic foveola is the central depression that is illustrated on OCT and is about 350 microns in diameter.

The best and most productive way to describe OCT findings is to break the anatomy up into 4 sections from anterior to posterior: The vitreous, intraretinal, sub-retinal and sub RPE, or choroidal.

A. Vitreous

The vitreous is the clear, egg white consistency fluid that fills the back of the eye. It is made up of 99% water and accounts for 80% of the total volume of the globe. The vitreous is attached to the retina, and eventually detaches from the retina in most patients, due to the breakdown of vitreous due to aging. Vitreous traction is a pathology that was never able to be imaged before OCT. Certainly, the effects of vitreous traction, such as edema and holes, were evident on both ophthalmoscopy and even fluorescein angiography, but the actual mechanical traction that caused these issues was not evident. In some cases, imaging vitreous traction and treating surgically before it causes other problems may help stem severe vision problems, such as macular holes, detachments, or vitreous hemorrhages.

We have chosen to include epiretinal membranes in this section, as they are visualized on OCT at the level above the nerve fiber layer, although the effect of epiretinal membranes can be seen in the layer that is termed “intraretinal”. Epiretinal membranes may present as a distinct dense layer above the NFL, and can sometimes be very adherent to the retina, which may give the impression of a normal retina. These membranes may also present as a separate entity, separated from the retina by space between the membrane and the retina. The effect of the traction caused by the membrane can be seen as intraretinal fluid or hemorrhages, caused by vascular leakage and edema. Pseudoholes of the macula may also be present, caused by openings in the membrane overlying the fovea. Epiretinal membranes also have been described as cellophane retinopathy and macular pucker.
Vitreous Traction

Vitreomacular traction. Note the attachments temporal, nasal, and central. There is also intraretinal edema present due to the mechanical traction.

Vitreomacular traction with intraretinal edema
In this case, the vitreous traction has pulled an area of the macula and created a macular hole.

Vitreous traction causing a separation of retinal tissue almost down to the level of RPE.

Vitreomacular traction seen on Time Domain OCT. The traction has created a large cyst in the fovea. In some clinical cases, this may be the precursor to a macular hole.
Partial Posterior Vitreous Detachment

Partial Posterior Vitreous Detachment

Vitreomacular traction on Time Domain
Posterior Vitreous Detachment

Vitreomacular traction with attachments temporally, nasally and centrally

Vitreomacular traction with multiple central attachment points
Vitreomacular traction adhered centrally, temporal, and nasal to the fovea

OCT and corresponding fundus image of a patient with a vitreous hemorrhage. As OCT uses light to image, anything that can block light will result in missing data. Note the areas of black shadowing on the OCT that represent missing data due to the light being blocked by the hemorrhage.

In many cases of vitreomacular traction, vitreous attachments may not be obviously attached at the retina, but telltale signs of these attachments may be represented by strands of highly reflective vitreous interface. The imager must recognize this finding and move the scan to demonstrate the attached point(s) of the vitreous to macular traction.
Macular traction missed, but note the vitreous “pointing” to the fovea

Same patient after moving the scan, with macular traction now revealed
Vitreomacular traction causing cystoid macular edema (CME)

Vitreomacular traction with edema and macular hole
Diabetic patient with red blood cells in the vitreous

Dense vitreous

Asteroid Hyalosis

Dense vitreous
Vitreomacular traction

Vitreomacular traction with early macular hole

Same patient, now progressed to full thickness macular hole
Dense posterior vitreous detachment with some attachments present in the temporal and nasal macular region

Vitreomacular traction with edematous retina

Vitreous hemorrhages can cause dense reflectivity of the OCT light, often times obscuring the retinal detail
Classic vitreomacular traction, with attachments in the central macula causing a large macular cyst

Vitreomacular traction with intraretinal and sub retinal fluid

Vitreomacular traction with epiretinal membrane and intraretinal fluid
Vitreomacular traction with partial thickness macular hole

Vitreomacular traction with cystoid macular edema on Time Domain OCT

Vitreomacular traction that has pulled macular tissue and created a macular hole
A posterior vitreous detachment with dense reflectivity above the macula. Note the attachment on the nasal side.

Vitreomacular traction, giving an ERM type appearance on the temporal side.

Vitreomacular traction with associated macular edema.
References

42. R. Margolis, R. Spaide A pilot study of EDI OCT of the choroid in normal eyes, AJO, May, 2009, pg. 811
Retinal Imaging Simplified

Author Darrin Landry provides a systematic guide of the basics needed to pursue and advance your education in ophthalmic imaging in his first book, *Retinal Imaging Simplified*.

While the majority of ophthalmic photographers have an extensive background in photography, they often require additional training to understand the different imaging modalities, how to properly image the eye, become familiar with retinal pathology, and how to interact with patients.

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About the Author

For over 25 years, Mr. Landry has worked in a variety of specialties as a military trained certified surgical technician. In 1989, he became an ophthalmic photographer and technician specializing primarily in retina.

Along with his wife, he is the co-owner of Bryson Taylor Inc., an ophthalmic consulting company started in 1999. As a speaker, consultant, and trainer, Mr. Landry has presented at workshops internationally, is a frequent lecturer for JCAHPO, OPS, ASORN, and the AAO. He is also a consultant for imaging companies, pharmaceutical companies, and medical practices.

He is a Certified Retinal Angiographer and an Optical Coherence Tomographer - Certified, has served as a Subject Matter Expert for the Ophthalmic Photographers’ Society Board of Certification, and a past member of the OPS Board of Education.

With numerous awards for his photography and professional speaking engagements, Mr. Landry has been published in various medical journals and textbooks including The Journal of Ophthalmic Photography, Insight, and Viewpoints. He is also the author of Retinal Imaging Simplified, a systematic guide to provide the basics to pursue and advance education in ophthalmic imaging.

In his free time, he loves to travel, hike, and spend time with his family. He has made several medical mission trips to Guatemala where he enjoys photographing the native culture.

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Optical Coherence Tomography
A clinical atlas of retinal images
By Darrin A. Landry, CRA OCT-C

Optical Coherence Tomography, a clinical atlas of retinal images is a richly illustrated and comprehensive guide to identifying anatomy and pathology of retinal disease as illustrated on OCT (Optical Coherence Tomography). Pertinent tips to acquiring quality images are outlined with both Spectral Domain and Time Domain for disease pathology, with multiple examples of diverse retinal disease images.

Over 350 examples of retinal disease pathology is illustrated in this book to assist the imager in identifying retinal disease, how it presents on OCT and to descriptively interpret OCT images.

This book is ideal for the beginner to advanced retinal imager and provides not only a valuable resource in the application of OCT imaging in this book, but also assists the imager in providing consistent quality clinical OCT images.

A well regarded teacher and lecturer in the field of ophthalmic imaging for the past 20 years, and the author of Retinal Imaging Simplified, Darrin Landry provides a clear and concise format for the imager to descriptively interpret OCT images.