

# **Advances and Emerging Applications of Spectral Domain Optical Coherence Tomography Imaging in Ophthalmology**

*Essay*

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Ophthalmology

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﴿قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا

إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ

الْعَلِيمُ الْحَكِيمُ﴾

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## *List of abbreviation*

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<b>3D- OCT</b>	Three dimensional OCT
<b>3D- SDOCT</b>	Three dimensional spectral domain OCT
<b>AMD</b>	Age related macular degeneration
<b>BIOM</b>	Binocular Indirect Ophthalmo Microscope
<b>BRVO</b>	Branch retinal vein occlusion
<b>CCD</b>	Charge-coupled device
<b>CNV</b>	Choroidal neovascularization
<b>CSCR</b>	Central Serous Chorioretinopathy
<b>dA</b>	Differential area
<b>DALK</b>	Deep Anterior Lamellar Keratoplasty
<b>DOCT</b>	Doppler OCT
<b>DOPU</b>	Degree of polarization uniformity
<b>DOPU<sub>min</sub></b>	Minimal DOPU value
<b>DSAEK</b>	Descemet's stripping automated endothelial keratoplasty
<b>EDI</b>	Enhanced Depth Imaging
<b>ELM</b>	External limiting membrane
<b>FDOCT</b>	Fourier domain OCT
<b>GCL</b>	Ganglion cell layer
<b>IJT</b>	Idiopathic Juxtafoveal Telangiectasia
<b>ILM</b>	Internal limiting membrane
<b>INL</b>	Inner nuclear layer
<b>IPL</b>	Inner plexiform layer,
<b>IS/OS</b>	Inner segment/outer segment parts of photoreceptors
<b>LASIK</b>	Laser Assisted in Sita Keratomileusis
<b>MMOCT</b>	Microscope Mounted OCT
<b>NAION</b>	Nonarteritic Ischemic Optic Neuropathy
<b>OCT</b>	Optical coherence tomography

## *List of abbreviation*

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<b>ODT</b>	Optical Doppler tomography
<b>OMAG</b>	Optical Micro-Angiography
<b>ONH</b>	Optic nerve head
<b>ONL</b>	Outer nuclear layer
<b>OPL</b>	Outer plexiform layer
<b>PDR</b>	Proliferative diabetic retinopathy
<b>PED</b>	Pigment epithelial detachment
<b>PFO</b>	Perfluoro-n-octane
<b>PR-DOCT</b>	Phase Resolved DOCT
<b>PS SDOCT</b>	polarization sensitive SDOCT
<b>PSL</b>	Polarization scrambling layer
<b>PSOCT</b>	Polarization sensitive OCT
<b>QWP</b>	Quarter wave plate
<b>RNFL</b>	Retinal nerve fiber layer
<b>ROP</b>	Retinopathy of prematurity
<b>RPE</b>	Retinal pigment epithelium
<b>RT</b>	Retinal thickness
<b>s</b>	Surface of blood vessel
<b>SDOCT</b>	Spectral domain OCT
<b>SLD</b>	Superluminescent diode
<b>SLO</b>	Scanning laser ophthalmoscope
<b>SVP</b>	Summed Voxel Projection
<b>TDOCT</b>	Time domain OCT
<b>TRBF</b>	Total retinal blood flow
<b>UHR SDOCT</b>	Ultrahigh resolution SDOCT

### *List of abbreviation*

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<b>UHR TDOCT</b>	Ultrahigh resolution TDOCT
<b>v</b>	Velocity vector
<b>v<sub>z</sub></b>	Doppler flow velocity
<b>VF</b>	Visual field
<b>VKH</b>	Vogt Koyanagi Harada
<b>θ</b>	Doppler angle



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## ***Introduction***

Optical coherence tomography (OCT), first reported as retinal imaging tool in 1991, is an interferometric tool for 3D imaging of objects hidden in scattering media such as the human eye (**Huang et al., 1991**).

Spectral domain optical coherence tomography (SDOCT) provides a number of advantages over conventional time domain OCT (TDOCT) systems, SDOCT offers higher acquisition speed and thus the ability to obtain significantly more images in a shorter period of time. This increased speed minimizes patient movement artifact and improves image resolution, the higher resolution obtained with SDOCT imaging may improve the detection of abnormalities (**Gupta et al., 2008**).

Doppler OCT (DOCT) imaging enables 3D visualization of the chorioretinal vasculature as in exudative macular diseases (**Makita et al., 2006**). Exudative macular diseases include age-related macular degeneration (AMD), which is the major cause of severe loss of central vision (**Klein et al., 1991**).

Conventional intensity based OCT achieves a high depth resolution of a few  $\mu\text{m}$  and can resolve several retinal layers, however it cannot directly differentiate different tissues. Polarization sensitive OCT (PSOCT) takes advantage of the additional polarization information carried by the reflected light and can thereby reveal important