Optical Coherence Tomography (OCT): Newer technologies and technical challenges

Since its invention in 1991 (Huang et al., 1991) optical coherence tomography (OCT) has seen increasingly wide application in medical imaging, due in part to its non-invasive nature and also the unmatched resolution provided by the most advanced instruments. In ophthalmology and optometry, high resolution cross-sectional images of the posterior eye, as captured by OCT, have become one of the most important diagnostic tools, allowing normal anatomical variations in retinal and/or choroidal morphology to be distinguished from early subtle changes, which may herald the onset of pathology. OCT is based on the principle of low coherence interferometry, with ophthalmic imaging instruments typically making use of long wavelength infrared light ranging from 840 nm to 1050 nm (Potsaid et al., 2010). Recent years have also seen rapid advances from the earliest time domain OCT (TD-OCT) instruments, with spectral domain (SD-OCT) and swept source OCT (SS-OCT) instruments offering improvements in image resolution of up to 3 – 5 μm.

Of the posterior ocular layers of the eye, the choroid has become the focus of attention from vision research and clinical communities. Choroidal thickness (CT) has long been known to be influenced by various physiological factors and with the development of improved imaging techniques, has been shown to undergo diurnal variation, when appropriately tracked. It has also been shown to be influenced by many other factors, including age, gender, ethnicity, refraction (myopia), and axial length. Most studies have measured CT, defined for imaging purposes as the distance from the posterior edge of the retinal pigment epithelium (RPE) to the choroidal scleral interface, using manual segmentation, with good interobserver and intersystem repeatability for subfoveal measurements (Mrejen & Spaide, 2013). While the time consuming nature of manual segmentation limits its application in a clinical setting, the alternative of automated segmentation remains limited due to the difficulty of reliably identifying the posterior choroidoscleral interface (Alonso-Caneiro et al., 2013).

With the addition of enhanced depth imaging, it is now feasible to visualise the structural details of the choroid, including the choriocapillaris, Haller's layer, and Sattler's layer (Singh et al., 2019). Other recent advances in imaging have allowed ocular blood flow, e.g., of the inner retinal layers to be evaluated. One such technique that has gained popularity in the last decade is optical coherence tomography angiography (OCTA), which allows for rapid acquisition of volumetric angiographic information of the retina. By visualisation of perfused retinal vasculature, various quantitative metrics such as foveal avascular zone area, vessel density, and vessel perfusion can be derived. Nonetheless, there are also potential shortcomings in published data, as such measurements are greatly influenced by a number of factors, including lateral magnification, which is directly influenced by the axial length of the individual and may differ from that used in an OCT instrument's calibration. Indeed, a recent review article reported that 468 (92%) of published articles did not consider lateral magnification, potentially leading to erroneous conclusions of their findings (Llanas et al., 2020).

In this special topic of the *Scandinavian Journal of Optometry and Vision Science* we invite contributions covering OCT imaging, with the goal of improved understanding of related technical issues across the research and clinical communities. We are specifically interested in receiving manuscripts on automatic segmentation of choroidal thickness and ocular blood flow measurements in both healthy and diseased eyes. We hope that by making OCT imaging a special topic in *SJOVS* we will also encourage collaboration between groups of researchers and clinicians towards developing evidence-based solutions for as yet unresolved technical issues with recent OCT technology.

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