Commentary: Choroidal thickness in the era of swept-source optical coherence tomography

In this issue of *Indian Journal of Ophthalmology*, the authors have performed a large study with 119 healthy patients (238 eyes) with an aim to establish a normative database of subfoveal choroidal thickness in Asian Indian eyes using the technology of swept-source (SS) optical coherence tomography (OCT).[1] The authors included subjects with a mean age of 28.7 years (range: 19–45 years). The authors concluded that the mean subfoveal choroidal thickness (in the central 1 mm) was 299.10 ± 131.2 µm compared with 294.8 ± 46.5 µm obtained using spectral-domain (SD) technology.[1] In the era of SS-OCT, which has inherent advantages of deeper choroidal penetration and lesser loss of sensitivity with depth, *quantitative* assessment of the choroid has gained relevance. SS-OCT provides distinct advantages of better delineation of retinal pigment epithelium–Bruch's complex and the sclerochoroidal junction, even in Asian eyes with heavy pigmentation.[2,3] In this article, the authors have also focused on comparing their findings with SD-OCT, a technology that is widely used in most retinal practices world over.[1]

It is well known from published literature that choroidal thickness is a highly dynamic parameter that can alter with minor physiological processes such as posture and time of the day.[4-7] Therefore, there are a number of caveats when assessing healthy individuals and patients for their choroidal thicknesses. Despite the challenges we face in quantifying the choroid, there are two aspects that need to be kept in mind when analyzing the images – *topographical variations* of the choroid[8] and *volumetric analysis*.[9] Normally, the choroidal thickness has a distinct pattern due to the anatomical configuration and blood flow. The choroid follows a contour as it thins out nasally toward the optic disc and is usually thickest around the fovea. In studies that focus on measurement of choroidal thickness, it is necessary to take this into account. With progressive research, variations in topography have assumed importance apart from calculation of the choroidal thickness, although much needs to be learnt yet. Similarly, with the premise that changes in hemodynamics and hemorheological parameters may be relevant too, assessment of *choroidal volume* has been performed by several authors to at least partly address this issue.[10,11] Using three-dimensional imaging such as the modern SS-OCT, it may be possible to obtain total choroidal volume (at least in the scanned area). Choroidal volume is likely to supplement the information obtained from choroidal thickness measurements as it seems to reflect pathological alterations due to blood flow. In summary, choroidal volume analysis is another aspect which goes well beyond measurement of thickness values.

Optimal imaging analyses of SS-OCT (or even SD-OCT) scans requires assessment of both quantitative and qualitative changes. Diseases of the choroid can result in changes in the *reflectivity*, *internal architecture*, *homogeneity*, and *back-scattering.* Each of these parameters indicate pathological changes in the various layers of the choroid, such as activity of choroidal lesions (reduced back-scatter in the presence of active lesions and increased reflectance after healing and atrophy),[12] type of choroidal granuloma (based on homogeneity),[13] and choriocapillaris ischemia (loss of architecture of the inner choroid/choriocapillaris indicates ischemia).[14] Using newer metrics, it may be possible to provide quantitative measures of these *qualitative changes*. For instance, Dastiridou *et al*. devised a new metric of choroidal reflectivity in patients with birdshot chorioretinopathy.[15] Choroidal vascularity index (CVI) is another novel metric that enables assessment of changes in the choroidal vasculature and interstitium and has found applications in various conditions such as ocular tuberculosis,[12] panuveitis,[16] and other entities. In this technique of assessment, OCT scans can be processed using semi-automated analytical software to obtain CVI, which can be later compared with a normative database.

Measurement of choroidal thickness at the location of a lesion may have more relevance rather than measuring it at the subfoveal region, especially in pathologies that predominantly result in focal choroidal change, such as toxoplasmosis. Moreover, if the disease is focal, one must bear in mind the normal choroidal topographical variations mentioned previously. On the other hand, diseases of the pachychoroid spectrum (such as central serous chorioretinopathy), Vogt–Koyanagi–Harada's disease, birdshot chorioretinopathy, among others, result in diffuse thickening of the choroid. Thus, as a clinician, when applying the results of studies on choroidal thickness for our patients in our clinics, it is imperative to consider the nature of the disease being dealt with and its biological behavior. After obtaining choroidal thickness measurements, drawing conclusions is possible when the true nature of the pathology is defined, either *focal* or *diffuse*.

With newer advances in technology and higher image acquisition speed, it is truly possible to assess the choroid *beyond the choroidal thickness* in the present time. In the future, SS-OCT devices may be capable of generating choroidal thickness maps for all scanned patients which may serve as a reference to detect future changes. By combining various factors such as choroidal thickness, volume, reflectivity, CVI, and other aforementioned features, a *composite choroidal evaluation* may be available in the future, greatly impacting our understanding of disease pathology and improving patient outcomes.

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