Corneal Confocal Microscopy Is Emerging as a Powerful Diagnostic Tool for Assessing Systemic Neurologic Disease

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The diagnosis and monitoring of systemic neurologic disease represents an ongoing and significant challenge. However, 21st century advances in ophthalmic imaging are opening up new opportunities for direct, instantaneous, in vivo, cost-effective, reiterative, noninvasive imaging of nerve morphology. Optical coherence tomography allows direct optical imaging of neural layers of the retina, and thinning of these layers has been shown to correlate with both ophthalmic and systemic diseases that involve nerve pathology. A technique that has been to some extent overshadowed by optical coherence tomography, in view of its perceived more limited utility in ophthalmic imaging, is corneal confocal microscopy. Proof of concept for assessing neurologic disease emerged from extensive research on the capability of this technique to diagnose, stage severity, monitor progression, and predict future incidence of diabetic peripheral neuropathy. Indeed, this technique is rapidly supplanting electrodiagnosis and skin punch biopsy as the new “gold standard” for assessing small fiber neuropathy in diabetes. The realization that ophthalmic nerve assessment can be used to assess systemic neurologic deficits has led researchers to explore the application of this technique to other disorders, such as Parkinson’s disease and multiple sclerosis. The study of Petropoulos et al. confirms and consolidates previous research by demonstrating how corneal confocal microscopy and optical coherence tomography are capable of detecting significant corneal and retinal nerve degeneration in patients with multiple sclerosis, which relates to the severity of neurologic deficits in patients exhibiting mild manifestations of this disease. Translation of ongoing research into wide-field imaging and automated image analysis holds promise for the deployment of this technology into routine clinical settings. More recent corneal confocal microscopy studies of the rate of corneal nerve migration, and how this parameter is slowed in the presence of diabetic peripheral neuropathy, may further extend the diagnostic capability of this approach.

References