

Diagnostic assessment of glaucoma and non-glaucomatous optic neuropathies via optical texture analysis of the retinal nerve fibre layer

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The clinical diagnostic evaluation of optic neuropathies relies on the analysis of the thickness of the retinal nerve fibre layer (RNFL) by optical coherence tomography (OCT). However, false positives and false negatives in the detection of RNFL abnormalities are common. Here we show that an algorithm integrating measurements of RNFL thickness and reflectance from standard wide-field OCT scans can be used to uncover the trajectories and optical texture of individual axonal fibre bundles in the retina and to discern distinctive patterns of loss of axonal fibre bundles in glaucoma, compressive optic neuropathy, optic neuritis and non-arteritic anterior ischaemic optic neuropathy. Such optical texture analysis can detect focal RNFL defects in early optic neuropathy, as well as residual axonal fibre bundles in end-stage optic neuropathy that were indiscernible by conventional OCT analysis and by red-free RNFL photography. In a diagnostic-performance study, optical texture analysis of the RNFL outperformed conventional OCT in the detection of glaucoma, as defined by visual-field testing or red-free photography. Our findings show that optical texture analysis of the RNFL for the detection of optic neuropathies is highly sensitive and specific.

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