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(U*) Retinal Image quality decreases in those with diabetes with increasing duration of disease and inversely with the level of disease control

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Introduction: The eye's optics change in those with type 1 diabetes mellitus. Known optical changes could impact both vision and imaging of diabetes-related changes to blood vessels, which are sight threatening. Here we investigate retinal image quality in those with diabetes and healthy controls.

Methods: Using novel methods, retinal image quality was derived for 1200 healthy eyes and 46 participants with type I diabetes mellitus with 47 age-matched controls. For each eye, a phase plate, generated from previously measured Zernike polynomials, was placed in an eye model in CODEV. Individual point spread functions (PSFs) and modulation transfer functions (MTFs) were generated. Image quality metrics were determined from PSFs: their diameter at 50% Encircled Energy (EE), Strehl Ratio (SR), and FWHM depth resolution and from MTFs: area under the Hopkins ratio (AHR).

Results: Expected decreased image quality with age was seen in the larger healthy dataset but not in the age-matched healthy controls. Lens thickness increased significantly with age with an additional effect of diabetes duration, in age-matched controls and those with diabetes. In those with diabetes, for at least one metric, image quality worsened with an increase in lens thickness and with variables related to diabetes: lack of diabetes control (glycated hemoglobin, HbA1c) and diabetes duration. A semi-log fit to lens thickness and HbA1c gave the best multiple variable fit of SR and AHR, global metrics of image quality, and good fits of depth and lateral resolution (EE and FWHM). Multiple variable linear fits of metrics of lateral and depth resolution (EE and FWHM) to HbA1c and diabetes duration gave the best fits.

Conclusions: Compared to healthy control eyes, image quality in eyes of those with diabetes worsens with increasing lens thickness, diabetes duration and lack of diabetes control (HbA1c). The lens thickness increases with diabetes duration. Reduced image quality may explain poorer vision in those with diabetes and may affect the sensitivity of retinal screening for sight threatening conditions. Extending this work could yield improved imaging instruments.

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