OCT biomarkers predictive for visual acuity in patients with diabetic macular edema

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Purpose: Many recent publications have correlated morphologic parameters to visual acuity (VA) to emphasize their importance as biomarkers in diabetic macular edema (DME) besides central retinal thickness (CRT). Most of these studies look at a single morphologic parameter. Our aim is to identify which of the evaluated 18 imaging biomarkers can predict VA when all are analyzed in one patient cohort and should therefore be used for automated ophthalmic image analysis.

Methods: All 311 Spectralis OCTs of the DRCR.net Protocol T trial have been manually evaluated by one trained grader of the Vienna Reading Center. The evaluation included presence/location/configuration of intraretinal cystoid fluid (IRC), shape of vitreomacular interface and foveal contour with/without epiretinal membrane, presence/height of subretinal fluid (SRF), presence/area of disrupted external limiting membrane (ELM) and inner-outer-segments line (IS-OS), ischemia (ISC), number of hyperreflective foci and CRT. To evaluate the predictive value of these parameters on baseline VA, multivariable linear regression models were calculated, using the backward method for variable selection and a resampling-based approach with 1000 samples. The source of the data is the DRCR.net, but the analyses, content and conclusions presented herein are solely the responsibility of the authors and have not been reviewed or approved by DRCR.net.

Results: From 18 potential biomarkers, the only predictive were area of disrupted ELM/IS-OS (selection percentage 95.90%/90.9%), presence of SRF (95%) followed by central mm (CMM)/centerpoint CRT (92%/69.6%) and ISC (63.1%). All other parameters showed less than 50% (=not important). When correcting for the other important parameters an ELM/IS-OS disruption of 0.1mm^2 causes a VA decrease of 1.3/0.8 letters, the presence of ELM/IS-OS disruption/ISC causes a mean VA loss of 4.0/1.4/4.8 letters, SRF protects VA by 4.1 letters and an increase in CRT in the CMM of 10µm causes a drop of 0.6 letters. The model performance showed an R^2=0.29.

Conclusions: Baseline VA correlates best with ELM and IS-OS integrity and SRF presence. Earlier studies allow the conclusion that SRF protects these layers. Automated analysis of ELM/IS-OS might allow VA prediction as their disruption is

directly related to irreversible photoreceptor destruction and VA loss. ELM/IS-OS disruption area might be used as a clinical endpoint in future clinical trials.