Introduction: OCT-angiography (OCTA) is a novel imaging method that provides detailed, depth-resolved information on the macular vascular network. This is the primarily affected site in diabetic retinopathy (DR), thus OCTA might be particularly useful in these patients by allowing a noninvasive assessment of microvascular net status. We conducted a study to assess the quantitative and qualitative changes of the macular vascular network that occur in nonproliferative diabetic retinopathy using OCTA.

Methods: Cross-sectional, case-control study, including patients with long-standing type 2 diabetes and nonproliferative diabetic retinopathy (DR). An age-matched control group (n=20) was used to establish the standards of a normal OCTA angiogram. Patients with macular edema, significant media opacities or any other ocular comorbidities, were excluded. All subjects underwent a complete ophthalmologic evaluation, followed by OCTA using the AngioVue™ OCTA system (Avanti, Optovue, USA). The Angioanalytics™ software was employed to automatically determine several vascular parameters: choroidal flow, superficial retina non-flow (foveal avascular zone - FAZ) and vascular density of the foveal and parafoveal sections (superior, inferior, nasal and temporal). Additionally, the presence of microvascular abnormalities was assessed and the area of both the superficial and deep FAZ was manually outlined by two independent graders using the image processing software ImageJ™.

Results: Twenty-five eyes of 15 patients, mean age 66.14±10.14 years, were included in this study. The angiograms of the DR group presented a sparse capillary network with perifoveal areas of capillary nonperfusion surrounded by vascular loops. Microvascular changes were more evident in the deep vascular network, where marked areas of capillary dropout and thinning were noted. The FAZ was consistently large and irregular, with loss of its usual centripetal arrangement of the bordering vascular network. In all the patients, the deep FAZ was larger than the superficial (0.51mm² vs 0.40mm²). The FAZ areas were inferior in the control group, both for the superficial (0.29mm², p=0.068) and the deep vascular plexuses (0.38 mm², p=0.046). Automatic superficial FAZ area determination was highly correlated with the manual measurements (r=0.867, p<0.001).Global vascular density was 43.51% on the patient group and 51.39% on the control group (p<0.001). Diabetic patients presented a statistically significant decrease of the vascular density in all of the extrafoveal areas (p<0.001). Similarly, choroidal flow area was significantly decreased in the DR group (1.81±0.11mm² vs 1.95±0.04mm² on the control group, p<0.001).

Conclusions: With the recent introduction of the Angioanalytics™ tool, automatic quantification of several parameters of microvascular flow became easily available, thus decreasing potential observer bias. Using this innovative software we identified a significant decrease in retinal vascular density and choroidal flow in diabetic patients, along with a consistently large and irregular FAZ. Microvascular abnormalities were particularly noticeable in the deep vascular plexus. These changes most likely reflect the microangiopathic nature of DR that can be manifest even in its nonproliferative form.