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Retinal microvascular network and microcirculation assessments in high myopia

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Abstract

Purpose: To investigate the changes of the retinal microvascular network and microcirculation in high myopia.

Design: A cross-sectional, matched, comparative clinical study.

Participants: Twenty eyes of twenty subjects with non-pathological high myopia (28 ± 5 Years) with a refractive error of -6.31 ± 1.23 Diopters (mean ± standard deviation) and twenty eyes of twenty age- and gender-matched control subjects (30 ± 6 years) with a refractive error of -1.40 ± 1.00 Diopters were recruited.

Methods: Optical coherence tomography angiography (OCTA) was used to image the retinal microvascular network, which was later quantified by fractal analysis (box counting, Dbox, representing vessel density) in both superficial and deep vascular plexuses. The retinal function imager (RFI) was used to image the retinal microvessel blood flow velocity (BFV). The BFV and microvascular density in the myopia group were corrected for ocular magnification using Bennett's formula.

Results: The density of both superficial and deep microvascular plexuses was significantly decreased in the myopia group in comparison to the controls ($P < 0.05$). The decrease of the microvessel density of the annular zone (0.6 – 2.5 mm), measured as D_{box}, was 2.1% and 2.9% in superficial and deep vascular plexuses, respectively. The microvessel density reached a plateau from 0.5 mm to 1.25 mm from the fovea in both groups, but that in myopic group was about 3% lower than the control group. No significant differences were detected between the groups in retinal microvascular BFV in either arterioles or venules ($P > 0.05$). Microvascular densities in both superficial ($r = -0.45$, $P = 0.047$) and deep ($r = -0.54$, $P = 0.01$) vascular plexuses were negatively correlated with the axial lengths in the myopic eye. No correlations were observed between BFV and vessel density ($P > 0.05$).

Conclusions: Retinal microvascular decrease was observed in the high myopia subjects, whereas the retinal microvessel BFV remained unchanged. The retinal microvascular network alteration may be attributed to ocular elongation that occurs with the progression of myopia. The novel quantitative analyses of the retinal microvasculature may help to characterize the underlying pathophysiology of myopia and enable early detection and prevention of myopic retinopathy.