Author Response: Diagnostic Ability of Retinal Arteriolar Diameter Measurements in Glaucoma

We thank Pekel et al.[1] for their interest in our work[2] and for the opportunity to discuss the findings of our study. They mentioned in their study that the mean retinal arteriolar caliber did not statistically differ between young relatives of patients with open-angle glaucoma (OAG) and age-matched healthy controls; however, we would like to point out that not all relatives of patients with OAG progress to glaucoma. Several studies reported that the lifetime risk of glaucoma was approximately 20% to 30% in relatives of patients with glaucoma[3,4] (i.e., approximately 70% to 80% of relatives did not suffer from glaucoma although they had a family history). We suggest that it will be meaningful to compare the baseline retinal vessel diameters (RVDs) between relatives who progressed to glaucoma over time and those who did not. In addition, the Blue Mountains Eye Study revealed that retinal arteriolar narrowing was associated with long-term risk of OAG and the authors proposed the concept that early vascular changes are involved in the pathogenesis of OAG.[5]

As already stated in our article, we agree with the point made by Pekel and Pekel.[6] That it is not clear whether the retinal arteriolar narrowing precedes or follows the development of glaucomatous damage. However, we suggest that the changes in retinal vascular diameter may occur even at an early stage of glaucoma development. Previously, our group reported that the central retinal arteriolar equivalent (CRAE) decreased over time in the progressed eyes, whereas no significant decrease was seen in the stable eyes in patients with bilateral normal-tension glaucoma (NTG).[7] Other studies by our group showed that patients with NTG had smaller diameters of the central retinal vessels than healthy subjects,[8] and the mean CRAE was smaller in the NTG than in the high-tension glaucoma group.[9] In those studies, most patients were categorized into early stage of glaucoma (mean deviation ≥ -6 dB).

Pekel and Pekel[6] pointed out a number of drawbacks regarding our article when using RVD as a diagnostic parameter. First, they were concerned that the methods used for measuring RVD cannot assess the three-dimensional and cross-sectional morphology of the vessel. Although we can only measure RVDs in two-dimensional images, RVD is known to have a significant correlation with retinal blood flow velocity when assessed by laser Doppler velocimetry.[10] Further, RVDs could be reliably measured using computer-assisted software and both interrater and intrarater reliabilities were high.[11] The second comment was that the quality of the retinal images may affect the RVD measurements. In our study, we excluded the RVD data from the disc photographs with poor image quality. Clinicians have to give attention to image quality when interpreting disc photographs. The third concern was that many systemic and ocular disorders might influence RVD. We agree that RVD has fundamental problems when used as a solitary diagnostic marker of glaucoma. Therefore, clinicians need to use RVD as a supplementary marker rather than a sole diagnostic tool. It would be helpful to reinforce the suspicion of glaucoma from the fundus photography for screening purposes. Fourth, they also mentioned other contributing factors, such as arteriolar pulsation, axial length, and IOP. As we pointed out above, several factors affect RVD measurements. However, Hao et al.[12] revealed that there are minimal variations in the CRAE and central retinal venular equivalent during cardiac cycles. As for the axial length, it might affect not only RVD but also retinal nerve fiber layer thickness.[13] In addition, RVD measurement will not be necessary when a subject has a high IOP, because clinicians will recommend further evaluation for glaucoma to an ocular hypertension patient. On the other hand, if a patient has a suspicious optic disc with a normal IOP, RVD may provide additional information for glaucoma diagnosis.

In summary, the RVD is a tool to be used in conjunction with other diagnostic methods. We believe that RVD would be a valuable supplementary marker of glaucoma diagnosis. We thank the authors for giving us a chance to discuss the role of RVD in glaucoma diagnosis.

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