Reply to Comment on: Foveal Crack Sign: An Optical Coherence Tomography Sign Preceding Macular Hole After Vitrectomy for Rhegmatogenous Retinal Detachment

WE THANK ARRIGO AND ASSOCIATES FOR THEIR POSITIVE and insightful comments on our work[1] and agree with their opinion that a primary alteration of the Müller cell cones might cause the onset of intraretinal hyperreflective lines (IHLs)/hyperreflective foveal spots (HFSs)/hyperreflective stress lines (HSLs) and foveal crack sign (FCS) alteration. We clarified that hyperrefractive lines on optical coherence tomography were preceding secondary macular holes (MHs) after pars plana vitrectomy for rhegmatogenous retinal detachment. We named these lines the *foveal crack sign* and interpreted FCS as the dehiscence of Müller cell cones caused by parafoveal epiretinal membrane (ERM) traction.

The IHL/HFS/HSL reported in previous studies[2–4] probably represents the same and the change or damage to Müller cell cones by inflammatory, degenerative, or tractional conditions. Basically, IHL/HFS/HSL in the previous studies includes the FCS of our study. IHL/HFS/HSL could, thus, be roughly divided into 2 types in terms of the development of MH.[2–4] The first type reflects the disruption of Müller cell cones by tangential traction and cause MH. The other type reflects the stress or damage to Müller cell cones by conditions other than traction, such as after closure of MH and resolution of macular hemorrhage, which would not cause MH. FCS would be of the first type because all of them were accompanied by parafoveal ERM[1]; that is, FCS would be included in IHL/HFS/HSL. Also, the representative case (Case 5, Figure 1 in our article[1]) showed that localization of this line extended from the inner retinal layer to the outer retinal layer as time proceeds; this suggest that the localization of this line may vary depending on the progression of tractional condition.

Future studies about this line (IHL/HFS/HSL, including FCS),[2–4] caused by either tangential traction or of the other type, should be separated (based on previous studies) because the data become noise when various case types are mixed. Additionally, as Arrigo and associates pointed out, the involvement of the retinal vascular network on this hyperreflective line (IHL/HFS/HSL) is interesting, especially in cases where the line resulted from damage or stress on the Müller cell cones by conditions other than traction. Although we focused on the tractional line, and clarified that this line (FCS) would be associated with MH, there are many unknowns, such as the relationship between the localization of this line and MH development; therefore, further larger studies are required.

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[1–4]SEE THE ORIGINAL ARTICLE[1] FOR ANY DISCLOSURES OF the authors.

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Comment on: Morphologic Features of Buried Optic Disc Drusen on En Face Optical Coherence Tomography and Optical Coherence Tomography Angiography

EDITOR:

WE READ WITH INTEREST THE WORK OF KIM AND ASSOCIates[1] and their use of optical coherence tomography angiography (OCTA) to define peripapillary vascular structures in eyes with presumed optic disc drusen (ODD) and optic disc edema (ODE) in an effort to understand pathogenesis and local architecture. We leave the question of their definition of ODD to a separate letter for which we are co-authors and focus here on the reported vascular abnormalities in various etiologies of ODE including papilledema, optic neuritis, and nonarteritic anterior ischemic optic neuropathy (NAION). They report a significant qualitative decrease in retinal peripapillary capillary (RPC) densities both in eyes with ODE of all causes together and ODD, and state that this occurs without

correlation with the severity of disc swelling in papilledema eyes. The authors acknowledge that their qualitative analyses of the OCTA images may be suboptimal, and we offer the following caveats to their statements that eyes with ODE have a greater level of RPC density reduction than eyes with presumed ODD and normal eyes. We previously studied OCTA changes in ODE from optic neuritis, NAION, and papilledema, using customized software to quantify the RPC.[2] We concur that RPC is reduced in NAION and optic neuritis/papillitis, but we found significant differences between these 2 entities and papilledema. Thus, we feel it is inappropriate and potentially misleading to group these 3 optic nerve disorders for comparison with ODD and normal controls. Furthermore, we showed that the papilledema group consisted of different grades of edema, and a significantly decreased PCD in high-grade papilledema when compared to grade 1 or 2 papilledema.

In other work, we compared OCTA findings in papilledema and pseudopapilledema eyes including ODD.[3] With OCTA, we found that the commercial software identified lower RPC density in both papilledema and pseudopapilledema eyes compared to normal eyes. However, when customized software was used to subtract large vessel (which, when obscured by disc swelling, can falsely lower the measured RPC density) contributions, then we found that normal and papilledema discs had the same RPC density, and pseudopapilledema discs had a significantly lower value. Based on these data, we advise great caution be exercised when interpreting qualitative or commercial software analyses of OCTA images of possibly swollen optic discs. Our studies were performed with spectral-domain systems, but we do not expect that swept source–based systems, without custom analysis as we have done, will yield different results.

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Reply to Comment on: Morphologic Features of Buried Optic Disc Drusen on En Face Optical Coherence Tomography and Optical Coherence Tomography Angiography

WE THANK DRS FARD AND SUBRAMANIAN FOR THEIR INTEREST in our paper and appreciate the opportunity to clarify important issues. They raised a question on the validity of comparing retinal peripapillary vascularity between optic disc edema (ODE) and optic disc drusen (ODD). Based on their previous study,[1] the authors asserted that quantitative measurements of vascularity on optical coherence tomography angiography (OCTA) are different among eyes having ODE with varying etiology and severity; thus, comparisons between ODD and unclassified ODE could be biased. However, we still believe that the analysis method in our study could be meaningful in the differentiation between ODD and ODE, for the following reasons.

First, our qualitative analysis of OCTA images showed clear distinction between ODD and ODE. In previous studies by Fard and associates, the authors quantitatively calculated the percentage of peripapillary capillary density in each eye within a specific region (eg, circle or sector around the optic nerve head) using customized software.[1,2] In contrast, we qualitatively evaluated the shape and presence of focal vessel density decrease in the radial peripapillary capillary (RPC) layer, as observed by the examiner. As a result, 25 of 62 (40.3%) eyes with ODE showed irregular regions of focal vessel density decrease in the RPC layer, while 23 of 92 (25.0%) eyes with buried ODD showed a C-shaped region of vessel density decrease in the same layer at the nasal side of the disc (Figure 3 in our article).[3] We believe that the vessel density might fluctuate but this characteristic pattern would not. Thus, distinctive patterns of peripapillary vascularity change between ODD and ODE could be used as a differential point. However, abnormal patterns of vascularity change could not be detected in the remaining 60% of eyes with ODE and 75% of ODD. Therefore, the use of OCTA alone is not effective enough in the differentiation between ODD and ODE compared to en face OCT and should be used as adjunct.

Second, one of the purposes of our study was to depict intuitive distinctions between ODE and ODD using commercial en face OCT and OCTA so that clinicians can easily detect without the use of specialized tools. As artifacts are common in identifying the RPC densities of papilledema using commercial software, a customized software is