Single shot widefield swept-source OCTA with 90° add-on lens

Kique Romero1; Thomas Callan, OD1; Zahra Nafar, PhD2; Warren Lewis, MS3; Fritz Soecknick4; Katharina Breher, PhD5; Siegfried Wahl, PhD6; Prof. Focke Ziemssen, MD1

1Carl Zeiss Meditec, Inc., Dublin, CA, USA; 2Bayside Photonics, Inc. Yellow Springs, OH, USA; 3Department of Ophthalmology, University of Tübingen, Tübingen, Germany; 4Carl Zeiss Vision GmbH, Aalen, Baden-Württemberg, Germany; 5Institute for Ophthalmic Research, University of Tübingen, Tübingen, Germany; 6Department of Ophthalmology, University of Leipzig, Leipzig, Germany

PURPOSE

• Widefield imaging techniques continue to expand the retinal field-of-view (FOV) of optical coherence tomography angiography (OCTA).
• Additional peripheral retina vasculature can be viewed with widefield OCTA, helping to decrease or eliminate the need for invasive procedures, such as fluorescein angiography.
• This study compares the expanded FOV of images captured using an external lens attachment to the standard FOV on a swept-source (SS) OCT system.

METHODS

• A 90° add-on lens was designed as an attachment to the PLEX® Elite 9000 (ZEISS, Dublin, CA) SS-OCT system (1060 nm central wavelength).
• This external positive meniscus lens module has the effect of increasing the maximum field angle to about 46° and decreasing the working distance from 28 mm to approximately 11 mm.
• PLEX Elite prototype software was modified and equipped with a widefield scan pattern (Angio 23x23mm) and automatic adjustment to compensate for the lens diopter and working distance.
• Subjects (age range 45-88 years) with various stages of diabetic retinopathy or retinal vein occlusion were scanned with the PLEX Elite. Each subject was scanned with the following two scan patterns:
  • Angio 15x15 mm (834 A-lines x 834 B-Scans acquired at 200kHz) without the add-on lens: FOV 60°.
  • Angio 23x23 mm (834 A-lines x 834 B-Scans acquired at 200kHz) with the add-on lens: FOV 90°.

RESULTS

• Paired images from 31 patients were reviewed by the expert observer. All 31 exhibited additional retinal abnormalities in the 90° FOV that were not seen in the standard 60° FOV.
• Figure 1 displays an expanded FOV where more microaneurysms (circled) along with additional areas of capillary nonperfusion can be seen beyond 60° in a patient with diabetic retinopathy.
• Figure 2 illustrates the extent of a vascular occlusion into the far periphery that is easily seen with the 90° FOV.

CONCLUSIONS

• We have demonstrated that additional retinal findings can be discovered by expanding the FOV to 90° with the use of an auxiliary lens attachment on the PLEX Elite.
• Capturing only one image is much more convenient than other methods that montage multiple images.
• This larger FOV continues to make OCTA an effective alternative to other widefield imaging modalities.

Email: kique.romero@zeiss.com

Disclosures: KR (E), TC (E), ZN (E), WL (C); Carl Zeiss Meditec, Inc.; FS (N); KB (E), SW (E): Carl Zeiss Vision GmbH; FZ (C): Abbvie, Apellis, Bayer Healthcare, Janssen, Novartis, Biogen, Boehringer-Ingelheim, Gementech/Roche, MSD, Novo Nordisk, Sanofi, Stada; FZ (B): Abbvie, Bayer Healthcare, Clearside, Kodiak, Novartis, Biogen, Gementech/Roche, Sanofi

Figure 1. (A) 90° OCTA en face projection of early diabetic retinopathy using add-on lens (B) 60° OCTA en face projection

Figure 2. (A) 90° OCTA en face projection of retinal vascular occlusion using add-on lens (B) 60° OCTA en face projection