Volumetric montage for large field of view optical coherence tomography angiography scans

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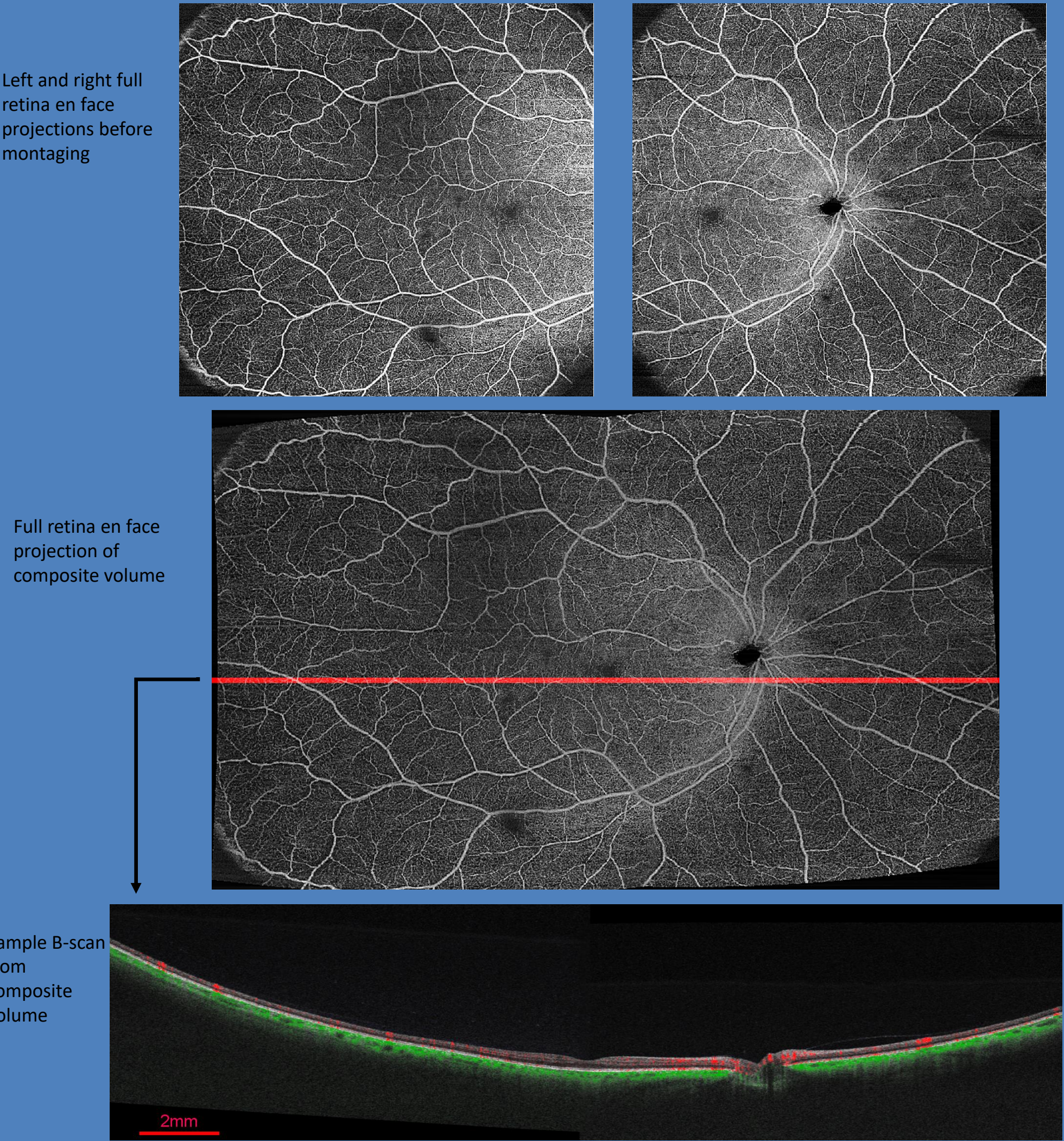
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PURPOSE

• To investigate whether high resolution large field of view (FOV) volumetrically montaged 15x15 mm optical coherence tomography angiography (OCTA) scans could provide the visualization of both the macula and extended periphery in one single volume.

• Unlike the case with 2D montage, continuous B-scans across the composite FOV may be referenced to the montaged en face images for easier location and interpretation of visible features.

METHODS

• Pairs of 15x15 mm x 6 mm deep OCTA scans were obtained using PLEX® Elite 9000 (ZEISS, Dublin, CA) with nasal and temporal fixations offset by 15 degrees from the center.

• First, a slab-based distortion-corrected montage was created using existing 2D compositing methods with full retina en face projections. Maps of point locations in each constituent 2D image were used to interpolate the points in the new volume.

• The depth registration of the two constituent volumes enabled identification of the appropriate voxels in these volumes that should contribute to each voxel in the combined volume.
  • Lookup tables generated from the slab montage were used to calculate the value of each voxel in the output volume.

• 30 pairs of 15x15 mm scans of 30 unique eyes from 19 subjects with varying degrees of diabetic retinopathy (DR), and with 15 degree nasal and temporal fixation offsets were obtained.

Left and right full retina en face projections before montaging

Full retina en face projection of composite volume

Sample B-scan from composite volume

2mm

	Left constituent	Right constituent	Montage
Average overall quality grade of en face projection (1-5)	3.5	3.4	3.6
Number of montages with discontinuity in at least one B-scan			2/30
Number of montages in which contribution from lower quality image was used in at least one region of overlap			8/30

• An experienced clinician evaluated each scan and assigned it a quality score from 1 (worst) – 5 (best) by evaluating the full retina en face and the B-scans.
  • The corresponding montages were also graded for quality according to the same criteria used for the inputs.

• The quality of the output was then compared with the two inputs to check for any clinically significant loss of quality.

RESULTS

• For the 30 pairs of images that were volume montaged, no montage was rated lower in quality than the lesser of the two inputs.

• In 8 of 30 cases, in the region of overlap of the two scans, a scan artifact or area of lower quality in one scan was used by the automated algorithm instead of the higher quality area in the other scan.

• In 2 of 30 cases, some discontinuity in the montaged b-scans was noticed.

CONCLUSIONS

• Montaging offset 15x15 mm OCTA scans, resulting in an approximately 15 mm(V) x 24 mm(H) x 6 mm(D) FOV, enables high resolution visualization of the periphery as well as the macula in a single volume with no loss of image quality.

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