Editorial

Ultra-wide-field fundus photography: can it replace Early Treatment Diabetic Retinopathy Study 7 field photography?

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Diabetes mellitus is a major cause of visual deficiency among working age adults and is estimated for visual impairment in 4.8% of the 37 million individuals who are visually impaired all over the world (1,2). A wide range of diabetic retinopathy microvascular changes are seen in the retina. Throughout the years, a screening device utilizing both advanced non-mydriatic fundus imaging and traditional mydriatic fundus camera has been utilized and has been found to be useful (1).

Aiello *et al.* (3) did a comparative study of Early Treatment Diabetic Retinopathy Study (ETDRS) standard 7 field photography and ultrawide-field (UWF) photography to determine the severity of diabetic changes in the retina [diabetic retinopathy (DR)]. The idea is very interesting to see if the area of standard 7 field ETDRS imaging on UWF image could detect retinal lesions as much as UWF image. Whether the peripheral retinal lesion in diabetic retinopathy could exists in addition to standard 7 field image lesions, hence enhancing the severity level of diabetic retinopathy. It has been shown that approximately 34% diabetic retinal lesions can exist outside the ETDRS standard 7 field in the retinal periphery (3).

The authors recommended that the study is a cross-sectional investigation of baseline information on an already ongoing assessment of 764 eyes of 385 individuals for 4 years (3). The aim was to assess how the peripheral retina observed using mydriatic UWF images can affect the assessment of DR severity and whether it is associated with DR worsening rates over time compared with ETDRS 7-field photography. With this objective, in the present investigation, they reviewed between the ETDRS 7-field zone to UWF pictures whether it can dependably be utilized instead of ETDRS imaging in future clinical trials. Other than this, they likewise assessed the peripheral zone in UWF pictures to evaluate DR lesions and area of changes outside the ETDRS zone. Besides, how peripheral DR changes can affect the evaluation of DR severity in contrast to ETDRS images.

In image acquisition, authors utilized only the central UWF images for grading. The DR severity grader agreement was moderately high in both methods of photographic assessment (weighted k: 0.88 to 0.93 for UWF and 0.83 to 0.84 for ETDRS 7 field). Very innovative, they digitally automatically overlaid to obscure the peripheral retina to uncover UWF masked picture and when the mask was removed, complete ultra-wide-field was assessed after completion of the UWF masked image. This has allowed them to grade retinal lesions outside the ETDRS standard 7 field area. The methodology appears controlled to answer the study questions.

A total of 764 eyes were included in the study. Based on the ETDRS imaging, non-proliferative diabetic retinopathy (NPDR) was present in 92.4% (695 of 752 eyes), of these 74.3% (559 eyes) having less than moderate NPDR. Comparing the ETDRS and UWF masked images within the same fields would validate the use of UWF utility to ETDRS 7 field images. Comparing prior to adjudication, 742 eyes were eligible for analysis. DR severity was equally matched between ETDRS 7 field and UWF pictures in 48.4% (359 eyes) and 653 eyes (88%) in 1 severity level, however, there was moderate agreement (weighted k 0.51).

After adjudication of ETDRS and UWF images, 130 eyes (17%) showed discrepancy of 2 or more in DR severity scale. Of these 130 eyes, 14 eyes were ungradable, leaving 116 eyes for adjudication. After adjudication, 737 eyes were compared. Four hundred thirty-five eyes (59%) matched exactly and within 1 severity scale in 714 eyes (96.9%). There was substantial agreement between the EDTRS 7 field and masked UWF images (weighted k 0.77).

While comparing the additional retinal lesions outside the ETDRS field in UWF, 751 eyes were gradable on UWF masked and unmasked images. The DR severity between masked and unmasked UWF pictures matched exactly in 86.3% (648 eyes). In unmasked UWF grading, more severe DR grading by step 1 was seen in 59 eyes (7.9%) and by 2 or more steps in 35 eyes (4.7%). Comparing the ETDRS with unmasked UWF images, severity of DR was more by 2 steps or greater in 76 eyes (10.2%) of unmasked photographs. This also highlights that unmasked UWF images can not only detect lesions within the ETDRS field but can also detect additional lesions affecting the DR severity scale implying its potential utility in future.

In one or more fields, mostly peripheral DR lesions were seen in 308 eyes (41%). Of these, 222 eyes (72.1%) matched exactly in masked and unmasked UWF images in DR severity grading. In 83 eyes (26.9%) had greater DR severity on UWF unmasked images and 34 (11%) had 2 or more DR severity steps. The distribution of additional lesions on unmasked images shows that new vessels elsewhere was predominantly seen outside the ETDRS field (approximately 45%) and other lesions (venous beading, IRMA and etc.) varied between 10–15% outside the ETDRS field. This justifies the earlier reported literature that UWF images can detect additional lesions (4,5).

The potential implications of the study by Aiello *et al.* (3) using UWF images are the following:

(I) detection of increased DR severity of about 11% of the eyes by 2 steps or more in unmasked UWF images;
(II) 2 imaging methods are comparable according to the study protocol, to determine the DR severity;
(III) maximizing image quality is of paramount importance and;
(IV) importance to study the progression of DR severity based on the additional peripheral lesions seen outside the ETDRS field.

It has been reported earlier, UWF camera (optomap) evaluation advantage compared to ETDRS 7-field stereo photography (1,6). Kernt *et al.* (6) have shown the agreement for readers for optomap were higher than 7 field photographs (Kappa 0.89 for optomap *vs.* 0.84 for 7 field photograph). UWF imaging allows posterior pole imaging and beyond the equator. It also allows manipulation with a red free and infrared image. Besides, visualizing the superficial and deep neurosensory retina selectively. In theory, it is more advantageous than 7 field photographs to avoid multiple acquisition of images (1).

The authors did conclude an important issue of identification of at-risk DR progression and onset of proliferative DR subset of patients that cannot be evaluated by ETDRS 7 field photography which would have significant impact for diabetic eye disease evaluation and treatment (3). The future implications of the present study would be (3):

(I) Use of UWF imaging may become an important tool in clinical research environments requiring accurate evaluation of possible rates of DR progression;
(II) Precise patient counseling clinical care;
(III) Teleophthalmology to improve assessment of risk and eye triage that would otherwise not have evaluated the retinal periphery.

Present research (3) does imply evidence of diabetic individuals with peripheral retinal lesions. We have also shown (1) the benefit of teleophthalmology of DR screening using Ultra Widefield fundus imaging detecting 9.2% of individuals with DR and is easy to capture the image.

In conclusion, ETDRS standard and UWF photography may have potential acceptable agreement on DR grading of severity and effectively can detect DR lesions outside the area of ETDRS 7 field adding to its advantage of understanding of progression of DR.

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References

1. Hussain N, Edraki M, Tahhan R, et al. Telemedicine for diabetic retinopathy screening using an ultra-widefield fundus camera. Clin Ophthalmol 2017;11:1477-82.
2. World Health Organization. Prevention of blindness from Diabetes mellitus: report of a WHO Consultation. World health Organization, Geneva, Switzerland, 2005.
3. Aiello LP, Odia I, Glassman AR, et al. Comparison of Early Treatment Diabetic Retinopathy Study Standard 7-Field Imaging With Ultrawide-Field Imaging for Determining Severity of Diabetic Retinopathy. JAMA Ophthalmol 2018;137:65-73.
4. Silva PS, Cavallerano JD, Tolls D, et al. Potential efficiency benefits of nonmydriatic ultrawide field retinal imaging in an ocular telehealth diabetic retinopathy program. Diabetes Care 2014;37:50-5.
5. Silva PS, Cavallerano JD, Sun JK, et al. Nonmydriatic ultrawide field retinal imaging compared with dilated standard 7-field 35-mm photography and retinal specialist examination for evaluation of diabetic retinopathy. Am J Ophthalmol 2012;154:549-59.e2.
6. Kernt M, Hadi I, Pinter F, et al. Assessment of Diabetic Retinopathy Using Nonmydriatic Ultra-Widefield Scanning Laser Ophthalmoscopy (Optomap) Compared With ETDRS 7-Field Stereo Photography. Diabetes Care 2012;35:2459-63.

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