Editorial

Ultra-wide field imaging in the screening of diabetic retinopathy

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Despite recent advancements in care, diabetic retinopathy (DR) remains an important cause of blindness (1,2). Screening of DR has been introduced as part of the health care systems in various countries (3-5), and, consequently, recent data from UK have demonstrated that DR is no longer the leading cause of blindness in the working-age population (6).

Severe visual loss in diabetes is often caused by proliferative DR (PDR) (7), given the high risk of vitreous hemorrhage or tractional retinal detachment in such eyes. However, PDR is often asymptomatic at first, and, hence, the primary aim of diabetic eye screening is to detect PDR prior to irreversible visual loss. This would allow timely delivered panretinal photocoagulation (8) or intravitreal vascular endothelial growth factor (9,10) in order to arrest disease progression.

The continued increase in the number of patients with diabetes (11) requires screening for DR to be fast and efficient for both patients and screening clinics, but it should still be able to detect patients at risk of sight-threatening retinopathy. In the pivotal Early Treatment Diabetic Retinopathy Study (ETDRS), retinal examination was performed by mydriatic 7-field, 30 degrees stereo images covering the posterior pole (12). While this image protocol has stood the test of time and is still considered the gold-standard for DR-imaging, it has some drawbacks which limit the use in clinical work. Most importantly, ETDRS-imaging is time-consuming and strenuous for the patient. Hence, a variety of other options have been tested.

Most studies have focused on other examining methods or tested the potential of using a smaller retinal field of view. Lin *et al.* tested the sensitivity of direct ophthalmoscopy in comparison with ETDRS-images and reported that this was only 34% (13). For fundus photography, more success was reported in the EURODIAB trial in which the use of mydriatic 2-field (centered at macula and optic disc), 45-degree images were validated against ETDRS 7-field with a median agreement of 77% (14). Boucher *et al.* tested the EURODIAB field of view but in a non-mydriatic approach (15). While sensitivities and specificities were acceptable, it was a concern that the non-mydriatic images only correctly identified one of 10 images graded as severe non-proliferative DR or PDR by ETDRS-images.

Given that the 2-field EURODIAB-images combine the use of few retinal images with the high quality of ETDRS-imaging, this approach is often used in diabetic eye screening. However, the introduction of ultra-wide field (UWF) imaging in recent years has changed the landscape. As compared to the 34% of the retinal surface visualized by 7-field ETDRS-imaging, it is now possible to image 82% with a single UWF image without losing important information (16). From a clinical point of view, this would be a very appealing concept; not just because of the use of only one retinal image per eye, but also due to the fact that peripheral DR-lesions lead to a more severe grading of disease in 10% of eyes (17) including a 1.9-fold higher chance of PDR detection (18). So far, clinical studies have demonstrated a moderate to high agreement between UWF imaging and ETDRS 7-field standards, and they have also confirmed that both methods have a very low number of

missed cases with PDR (17,19).

In a recent well-designed multicenter study, Aiello *et al.* aimed to compare the agreement in DR-grading between UWF images (utilizing the full field of view), UWF (masked to include only the ETDRS 7-field area), and ETDRS 7-field images (16). In a cross-sectional design, 764 eyes of 385 patients were included. The study reported that ETDRS-images had a moderate agreement with ETDRS-masked UWF imaged but a substantial agreement with unmasked UWF-images. When ETDRS 7-field images and UWF unmasked images were compared, a 2 or more steps increase in level of DR was found in 10.2% of the latter group. While the study was limited by the cross-sectional design, it adds to the evidence that UWF imaging compares well with the ETDRS gold-standard.

The prediction of progression in DR to high risk retinopathy was assessed by the ETDRS. When capturing the far periphery, additional lesions are detected in 10.0–14.7% (17), of which lesions in the latter ranged from microaneurysms and hemorrhages (69.4%) to new vessels elsewhere (3.2%). Whether the risk of progression increases by the findings of these lesion, has remained uninvestigated, but a recent study found a 3.2 increased risk of progression of DR, and a 4.7 increased risk of progression to PDR in patients with predominantly peripheral lesions during a 4-year period. The study by Aiello *et al.* (16) was considered a baseline for a preplanned 4-year prospective trial, which will provide important information regarding the importance of peripheral DR-lesions.

UWF provides high quality images for DR-screening which can be captured in much lesser time than ETDRS 7-field (20,21) and often with high quality even in non-mydriatic images (18). It often adds substantial peripheral information that may be important for treatment decisions or in order to individualize screening intervals. This may, ultimately, be of assistance to doctors in order to design more optimal screening programs for DR-detection.

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References

1. Grauslund J, Green A, Sjolie AK. Blindness in a 25-year follow-up of a population-based cohort of Danish type 1 diabetic patients. Ophthalmology 2009;116:2170-4.
2. Klein R, Lee KE, Gangnon RE, et al. The 25-year incidence of visual impairment in type 1 diabetes mellitus the wisconsin epidemiologic study of diabetic retinopathy. Ophthalmology 2010;117:63-70.
3. Grauslund J, Andersen N, Andresen J, et al. Evidence-based Danish guidelines for screening of diabetic retinopathy. Acta Ophthalmol 2018;96:763-9.
4. Stefánsson E, Bek T, Porta M, et al. Screening and prevention of diabetic blindness. Acta Ophthalmol Scand 2000;78:374-85.
5. Scanlon PH. The English National Screening Programme for diabetic retinopathy 2003-2016. Acta Diabetol 2017;54:515-25.
6. Liew G, Michaelides M, Bunce C. A comparison of the causes of blindness certifications in England and Wales in working age adults (16-64 years), 1999-2000 with 2009-2010. BMJ Open 2014;4:e004015.
7. Four risk factors for severe visual loss in diabetic retinopathy. The third report from the Diabetic Retinopathy Study. The Diabetic Retinopathy Study Research Group. Arch Ophthalmol 1979;97:654-5.
8. Preliminary report on effects of photocoagulation therapy.

The Diabetic Retinopathy Study Research Group. Am J Ophthalmol 1976;81:383-96.
9. Writing Committee for the Diabetic Retinopathy Clinical Research Network, Gross JG, Glassman AR, et al. Panretinal Photocoagulation vs Intravitreous Ranibizumab for Proliferative Diabetic Retinopathy: A Randomized Clinical Trial. JAMA 2015;314:2137-46.
10. Sivaprasad S, Prevost AT, Vasconcelos JC, et al. Clinical efficacy of intravitreal aflibercept versus panretinal photocoagulation for best corrected visual acuity in patients with proliferative diabetic retinopathy at 52 weeks (CLARITY): a multicentre, single-blinded, randomised, controlled, phase 2b, non-inferiority trial. Lancet 2017;389:2193-203.
11. Guariguata L, Whiting DR, Hambleton I, et al. Global estimates of diabetes prevalence for 2013 and projections for 2035. Diabetes Res Clin Pract 2014;103:137-49.
12. Grading diabetic retinopathy from stereoscopic color fundus photographs--an extension of the modified Airlie House classification. ETDRS report number 10. Early Treatment Diabetic Retinopathy Study Research Group. Ophthalmology 1991;98:786-806.
13. Lin DY, Blumenkranz MS, Brothers RJ, et al. The sensitivity and specificity of single-field nonmydriatic monochromatic digital fundus photography with remote image interpretation for diabetic retinopathy screening: a comparison with ophthalmoscopy and standardized mydriatic color photography. Am J Ophthalmol 2002;134:204-13.
14. Aldington SJ, Kohner EM, Meuer S, et al. Methodology for retinal photography and assessment of diabetic retinopathy: the EURODIAB IDDM complications study. Diabetologia 1995;38:437-44.
15. Boucher MC, Gresset JA, Angioi K, et al. Effectiveness and safety of screening for diabetic retinopathy with two nonmydriatic digital images compared with the seven standard stereoscopic photographic fields. Can J Ophthalmol 2003;38:557-68.
16. 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. [Epub ahead of print].
17. Silva PS, Cavallerano JD, Sun JK, et al. Peripheral lesions identified by mydriatic ultrawide field imaging: distribution and potential impact on diabetic retinopathy severity. Ophthalmology 2013;120:2587-95.
18. Wessel MM, Aaker GD, Parlitsis G, et al. Ultra-wide-field angiography improves the detection and classification of diabetic retinopathy. Retina 2012;32:785-91.
19. Rasmussen ML, Broe R, Frydkjaer-Olsen U, et al. Comparison between Early Treatment Diabetic Retinopathy Study 7-field retinal photos and non-mydriatic, mydriatic and mydriatic steered widefield scanning laser ophthalmoscopy for assessment of diabetic retinopathy. J Diabetes Complications 2015;29:99-104.
20. Neubauer AS, Kernt M, Haritoglou C, et al. Nonmydriatic screening for diabetic retinopathy by ultra-widefield scanning laser ophthalmoscopy (Optomap). Graefes Arch Clin Exp Ophthalmol 2008;246:229-35.
21. 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.

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