Ophthalmoscopy versus non-mydriatic fundus photography in the detection of diabetic retinopathy in black patients

W. F. MOLLENTZE, A. A. STULTING, A. F. STEYN

Summary

The contribution of non-mydriatic fundus photography in the detection of diabetic retinopathy before and after dilatation of the pupils in black diabetics was investigated and compared with direct ophthalmoscopy. Eighty-six patients were examined and good-quality photographs were obtained for 54,7% of eyes before and 86,6% of eyes after dilatation. Photographically documented retinopathy was detected by ophthalmoscopy in only 64,7% of eyes. The two methods were concordant for the presence of retinopathy in 62,2% of eyes before and 56,9% of eyes after dilatation. Photography through dilated pupils also improved the rate of detection of diabetic retinopathy from 24% to 30%. The 45° non-mydriatic fundus camera was found to be a valuable adjunct in the detection of diabetic retinopathy in a busy diabetic clinic.

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Diabetic eye disease is a leading cause of blindness in the Western world today, with diabetic retinopathy responsible for 70% of cases of diabetic blindness.[1] Photocoagulation treatment has been shown to be effective in preserving vision in eyes with proliferative retinopathy as well as diabetic maculopathy.[2,3] The prevalence of diabetic retinopathy was found to be 26,7% in a large diabetic clinic, with 9,5% of patients having serious retinopathy.[4] Screening for diabetic retinopathy in any diabetic clinic should therefore be a matter of priority.

Responsibility for screening for diabetic retinopathy in a busy diabetic clinic such as our own often rests solely upon the attending doctors. Frequently they are inexperienced and not permanent members of the diabetic team. Furthermore, the ability of non-ophthalmologists to identify serious diabetic retinopathy has been questioned.[5]

Several studies have demonstrated the usefulness of a 45° non-mydriatic fundus camera in the detection of diabetic retinopathy through an undilated pupil.[6-8] A major drawback of this technique is the fact that the camera covers a field of 45° and only the posterior pole of the retina is visualised. This includes the optic disc, the macula, the central retina just temporal to the macula and both the lower and the upper temporal vessels (Fig. 1). The possibility that the camera can miss serious peripheral retinopathy has been pointed out.[9] A further disadvantage of non-mydriatic fundus photography is the high rate of poor-quality photographs.[7]

This study was undertaken to evaluate non-mydriatic fundus photography as a means of detecting diabetic retinopathy in black patients, whose retinas are more heavily pigmented than those of whites. A further objective was to compare the ability of our medical staff to detect diabetic retinopathy with that of the camera. The final objective was to ascertain the role of photography through a dilated pupil in an effort to improve the quality of photographs.

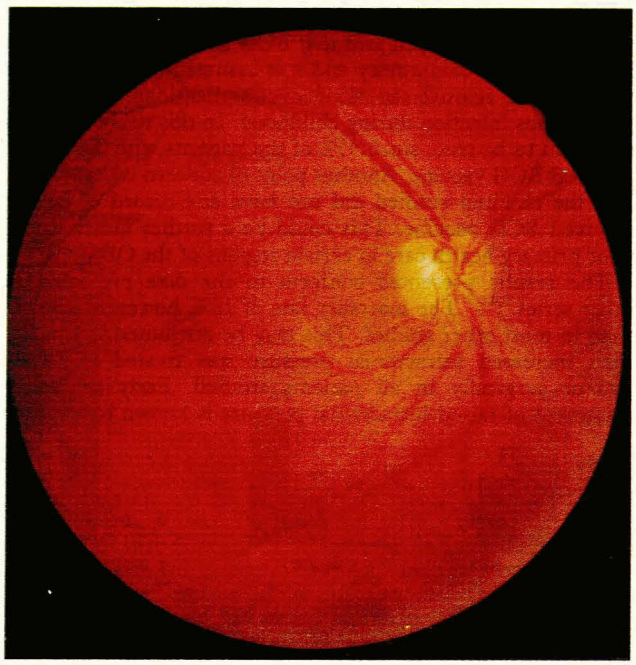

Fig. 1. Example of a colour photograph of the right fundus as obtained by non-mydriatic fundus photography.

Patients and methods

Pelonomi Hospital is a 1 200-bed teaching hospital, and 90 - 100 patients a week are seen at the diabetic clinic. The clinic is staffed by 1 consultant physician, 2 registrars, 1 medical officer, 2 interns and 2 final-year medical students. Patients included in this study were on our routine screening programme for long-term complications. Each week the first 9 -10 patients who had had diabetes for more than 5 years were selected. Patients who had undergone previous eye surgery were excluded.

Direct ophthalmoscopy was performed through undilated and dilated pupils in a darkened room and no time limit was set to the ophthalmoscopists. A modified World Health Organisation scoring system was used to document the degree of retinopathy as seen at the posterior pole of the retina that corresponded to the photograph obtained, on a schematic chart.[10] Lesions seen outside this area could also be recorded.

Non-mydriatic fundus photography was performed in a darkened room by the official hospital photographer using the Canon CR4-45NM retinal camera with a Polaroid film back. Only one exposure of each eye was permitted regardless of the quality of the photograph before and after dilatation of the

Departments of Internal Medicine and Ophthalmology, University of the Orange Free State, Bloemfontein, OFS
W. F. MOLLENTZE, M.MED. (INT.), F.C.P. (S.A.)
A. A. STULTING, M.MED (OPHTH.)
A. F. STEYN, M.MED. (INT.)

pupil. Even if a cataract was present an attempt was made to obtain a photograph. A waiting period after the flash for patients with undilated pupils was allowed so that the other eye could recover from the flash before photography. The photographs were graded with the naked eye by an independent observer (A. A. S.) and the results recorded in a similar way on a chart similar to that used to record results of ophthalmoscopy. The observer was unaware of the results of fundoscopy. The quality of the photographs was recorded as 'good' only when the whole area of interest was visible and sharply focused. When part of the photograph was obscured by a dark area or ring of light at the periphery or when it was out of focus, it was regarded as of 'poor' quality. The photographs were graded as 'unusable' when no retinal detail could be seen.

Results

Eighty-six patients, mostly with non-insulin-dependent diabetes, were examined. The average duration of diabetes was 9,5 years (range 5 - 26 years).

The number of good photographs obtained was 94 (54,7%) before and 149 (86,6%) after dilatation (Table I).

Table II compares the severity of retinopathy according to direct ophthalmoscopy and non-mydriatic photography. Retinopathy was detected by ophthalmoscopy in 43 eyes (34 + 9) (25%) before and 70 eyes (50 + 20) (40,7%) after dilatation. The corresponding figures for the camera were 42 eyes (41 + 1) (24,4%) and 51 eyes (49 + 2) (29,7%), respectively. Agreement between ophthalmoscopy and the camera with regard to the presence or absence of diabetic retinopathy was reached in 107 eyes (62,2%) before and 98 eyes (56,9%) after dilatation. Diabetic retinopathy was detected in 51 of 172 photographs (29,7%) obtained through dilated pupils (Fig. 2). In only 33 (20 + 11 + 2) of these (64,7%) was retinopathy detected by ophthalmoscopy. Diabetic retinopathy was missed on ophthalmoscopy in 18 eyes.

Discussion

The somewhat more heavily pigmented retinas of black patients posed no problems and it was possible to obtain photographs of acceptable quality in the majority of cases. The proportion of good photographs obtained before dilatation (54,7%) compared favourably with the figure of 41% reported by Ryder *et al.*[7] However, dilatation of the pupil improved the number of good photographs by 31,9% (from 54,7% to 86,6%) (Table I). This dramatic improvement in the quality of photographs is of major importance, since the Polaroid films constitute the bulk of the running costs of the system. More important, the detection rate for retinopathy was also increased from 24% to 30% after dilatation (Table II). Photography through dilated pupils is also less time-consuming and taxing for both operator and patient. Photography through a dilated pupil was well tolerated. According to Klein *et al.*,[6] no association was found between dilatation of the pupil and subjective discomfort with the flash.

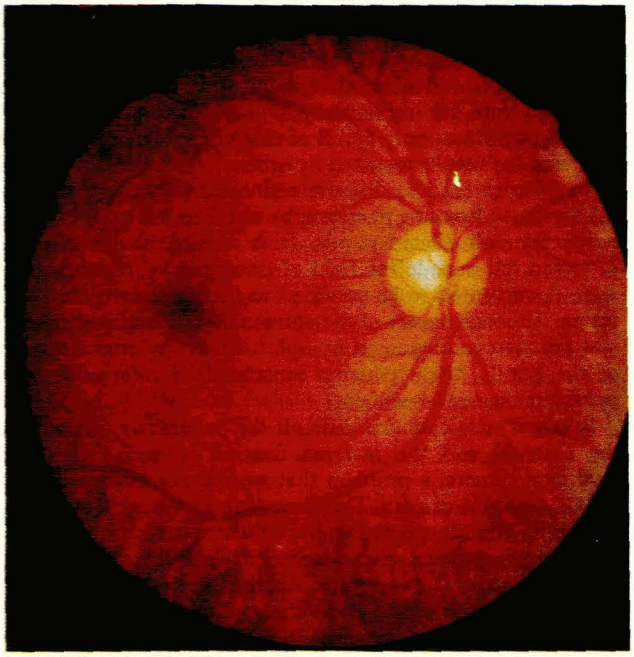

Fig. 2. Colour photograph of the right fundus obtained through a dilated pupil showing background retinopathy and laser spots.

TABLE I. RATING OF THE QUALITY OF POLAROID PHOTOGRAPHS BEFORE AND AFTER DILATATION OF THE PUPIL

	Unusable		Poor		Good		Total No. of photographs taken
	No.	%	No.	%	No.	%	
Before dilatation	**17**	**9,9**	**61**	**35,5**	**94**	**54,7**	**172**
After dilatation	**6**	**3,5**	**17**	**9,9**	**149**	**86,6**	**172**

TABLE II. COMPARISON OF SEVERITY OF RETINOPATHY BY DIRECT OPHTHALMOSCOPY AND 45° CAMERA BEFORE AND AFTER DILATATION OF THE PUPIL

	45° camera									
	No retinopathy		Non-proliferative retinopathy		Proliferative retinopathy		Cannot determine		Total	
Ophthalmoscopy	Bef.	After	Bef.	After	Bef.	After	Bef.	After	Bef.	After
No retinopathy	**82**	**71**	**16**	**18**	**0**	**0**	**11**	**1**	**109**	**90**
Non-proliferative retinopathy	**16**	**30**	**17**	**20**	**0**	**0**	**1**	**0**	**34**	**50**
Proliferative retinopathy	**5**	**7**	**3**	**11**	**1**	**2**	**0**	**0**	**9**	**20**
Cannot determine	**8**	**7**	**5**	**0**	**0**	**0**	**7**	**5**	**20**	**12**
Total	**111**	**115**	**41**	**49**	**1**	**2**	**19**	**6**	**172**	**172**

Bef. = before dilatation; After = after dilatation.

Agreement between ophthalmoscopy and photography was not substantially altered by the status of the pupils, as is evident from the figures of 107 eyes (62,2%) and 98 eyes (56,9%) before and after dilatation, respectively. However, the detection rate for retinopathy by ophthalmoscopy through dilated pupils was only 64,7% of that of the camera. This is in line with the results reported by others.[5,7]

In 37 eyes (21,5%) diabetic retinopathy that could not be substantiated from the photographs was detected by ophthalmoscopy through dilated pupils. It is possible that the lesions observed fell outside the field of photography, although they were documented to be confined to the posterior pole of the retina. Although we are of the opinion that diabetic retinopathy was grossly overdiagnosed by ophthalmoscopy after dilatation of the pupils, these patients must still be referred for full ophthalmological assessment.

Rosen *et al.*[11] found it difficult for patients to follow both the external and the internal fixation lamps of the non-mydriatic camera, a problem that we did not encounter with the CR4-45NM camera. The same authors also criticised non-mydriatic fundus photography on the grounds that it did not detect peripheral retinal ischaemia, peripheral intraretinal micro-angiopathy, or even macular oedema. However, the same applies to most other fundus cameras when fluorescein angiography is not performed.

In conclusion, we found the CR4-45NM camera easy to operate and no photographs were lost due to malfunction. We also found photography through a dilated pupil to be superior to non-mydriatic fundus photography. The camera proved itself valuable in conjunction with ophthalmoscopy as a means of screening for diabetic retinopathy under our clinic circumstances. In addition to providing permanent records of a patient's retina, the camera also provides excellent material for student education.

We are indebted to Mr R. Taylor for taking the photographs and to the staff and patients of the diabetic clinic for their co-operation.

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