Screening schemes for diabetic retinopathy

Graham Ridgewell BSc (Hons) FBCOptom

Optometrist, Chapel-en-le-Frith, Derbyshire

I have been in independent practice in Chapel-en-le-Frith for 25 years. I am a member of North Derbyshire Local Optical Committee and for the past nine years have had a special interest in the development of co-management schemes. When not stuck in my windowless consulting room, I enjoy offshore yacht racing

The Diabetes NSF has moved screening for diabetic retinopathy up the agenda. Graham Ridgewell discusses the recent developments, to help you assess efforts in your area to meet the requirements

THIRTY YEARS AGO, in my university days, I can recall a supervisor in the open clinic trying to explain to a patient that it was not his spectacles that needed changing, it was his diabetes that was causing the problems with his vision. The reply came back, "But I'm not diabetic!" This scenario was not uncommon in my early practice, when retinopathy noted during a routine sight examination would detect three or four undiagnosed diabetics each year.

Background to the screening programme

Diabetes, which in the developed world is the biggest cause of blindness among people of working age, affects about 2% (and rising) of the population. Fewer than 5% of people with diabetes will have retinopathy when diagnosed, but the proportion rises up to 90% after 20 years, by which time about 7.5% will have developed "sight-threatening" retinopathy.

The watershed in terms of screening was the 1989 St Vincent Declaration, which called for the incidence of diabetes-related blindness to be reduced by one-third over five years. While the timescale proved optimistic, it got interested professionals collaborating to improve the status quo.

The ideal – examination of every diabetic by an ophthalmologist – is ruled out by patient numbers and by cost, not to mention the inconvenience to the patient of having to travel to and wait at the hospital. The need, therefore, is to devise a method of selectively screening people with diabetes, to find those with retinopathy that would benefit from treatment.

Current schemes

The first UK diabetic retinal screening scheme was started in Bradford in 1993. All diabetics in the area were asked to attend Bradford University or Bradford Royal Infirmary to have retinal photographs taken (on 35 mm film). It soon became evident that the resources were not being used very efficiently. Apart from the number of ungradeable pictures and nonattendance, about 70% of the images showed no sign of retinopathy.

After a rethink, the local optometrists were invited to provide the initial screening, and then only those diabetics with any signs of retinopathy were sent to have pictures taken. This hybrid system is still working, and the Health Authority has now purchased five more cameras (now digital) that are based in optometrists' practices.

There is no national screening protocol, so the nature of your local screening system (if any) will depend on where you practise. Some GPs perform their own inhouse screening, there are some purely camera-based schemes, and there are now more than 60 optometrist-based co-management schemes. All English protocols require the pupils to be dilated and many require the fundus to be viewed using slit-lamp binocular indirect microscopy (BIO).

The aim of all the schemes is to keep patients with no retinopathy or nonsight-threatening background retinopathy out of the hospital, while ensuring that those with maculopathy or preproliferative retinopathy see an ophthalmologist before their sight becomes threatened by proliferative retinopathy (Figure 1).

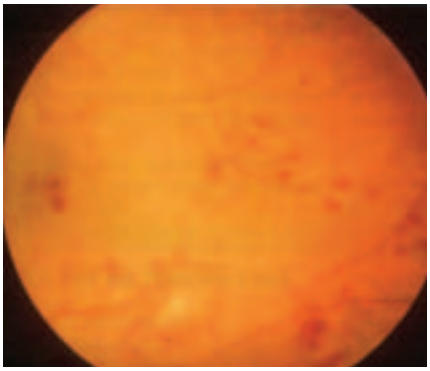

Figure 1. Sight-threatening proliferative retinopathy in a person with diabetes, showing multiple haemorrhages and new vessel formation

Screening in practice

2003 saw the launch of the National Service Framework for Diabetes, which shifted down to PCT level the responsibility for delivering improvements in the provision of care.[1] The NSF requires that, by 2006, 80% of people with diabetes (100% by the end of 2007) are offered screening for the early detection (and treatment, if needed) of diabetic retinopathy as part of a systematic programme that meets national standards. It is not the intention to change successful schemes in the immediate future, but they should progressively adopt the new technology of digital cameras.

Resources are thinly spread

A total of £27m has been allocated over the next three years, to be distributed by the Strategic Health Authorities to the PCTs, to support the purchase of digital cameras and related software. This apparent largesse will fund only about one camera per 100,000 head of population. From the first year's allocation, the three PCTs in my own area have just received £35,000, which will not even cover the purchase, maintenance and operating costs of one camera.

How can best use be made of a single camera over such a large area? It could be based at a single, central location, such as the local hospital, which is fine in an urban environment; or it could be moved around the area, spending a given length of time at each GP surgery, community clinics or optometrist practice; or it could be truly mobile, like a chest X-ray unit, which would suit a rural area. In any event, patients used to having their screening performed locally will find the new modality less convenient.

A role for optometrists

An alternative is to use a hybrid system such as the Bradford scheme described above, where, initially, only those with retinopathy are photographed; then, as funding for more cameras becomes available, photography can be offered to everyone. Another possibility is to offer a grant to interested optometrists to purchase cameras that could be used in their own practice, for other purposes in addition to diabetic retinopathy screening. Many optometrists are on the verge of investing in this new technology and are waiting only for the list of recommended cameras and suppliers – due any time now – to be issued by the National Screening Committee (NSC). In grant form, the limited capital funds may well be able to finance five or six cameras that would be locally based, throughout the community, rather than one centrally based machine.

Keeping screening in the hands of the optometrists would also give the patient the advantage of having the images instantly assessed; additionally, in the event of an image being ungradeable, BIO could be performed, thus saving the patient a second appointment and another dose of mydriatic. Because the retinopathy screening often accompanies the normal NHS eye examination, it is a good opportunity to detect co-morbidity.

Why embrace digital technology?

There are three alternatives to the use of a digital camera for retinopathy screening:

- Direct ophthalmoscopy.
- Binocular indirect ophthalmoscopy.
- Conventional fundus photography.

I shall consider each in turn.

Direct ophthalmoscopy

We all have a direct ophthalmoscope and use it to a greater or lesser extent. Direct ophthalmoscopy is an acquired art, and its effective use requires skill and practice. The main problem is the limited field of view – usually only the area of the optic disc – which, when coupled with a patient with poor fixation, can make examination of the whole of the fundus quite challenging. The image you see is monocular, which makes subtly raised areas at the optic disc or macula even more difficult to detect. The macula area is especially difficult to see because of corneal reflections. Having a dilated pupil and asking high myopes to wear their specs does make things easier, but even then you can never be 100% sure that nothing has been missed. Also, this method of viewing does not meet the 80% test sensitivity required by the Diabetes UK Audit Standards.[2]

Binocular indirect ophthalmoscopy

This method requires the patient to sit with their head, fairly immobile, on the chinrest while the fundus is viewed with the slit-lamp biomicroscope through a condensing lens (Figure 2). The magnification and field of view of the image can be altered by changing the eyepieces on the microscope, and by using different powers of the condensing lens. BIO gives the degree of magnification required to pick up small lesions and a large field of view, coupled with good stereopsis. It can

Figure 2. Slit-lamp binocular indirect ophthalmoscopy (BIO).

"Direct ophthalmoscopy is an acquired art, and its effective use requires skill and practice"

Figure 3. Canon CR6 fundus camera

also give a much better view of the fundus when cataracts are present than direct ophthalmoscopy. BIO has become the gold-standard method of viewing the fundus and is used in hospitals almost to the exclusion of direct ophthalmoscopy.

Conventional fundus photography

The fundus camera (Figure 3) has been around for a long time and has mainly been used in the universities or hospitals with larger ophthalmology departments. There has always been a trade-off between speed and quality as far as the pictures are concerned. The best-quality pictures are still taken using 35 mm film, but the processing time can be a problem, as can matching the pictures with the right patient! A Polaroid camera gives an almost instant print, but the quality is comparatively poor.

Digital fundus photography

In recent years, improvement in the quality of digital images has occurred at the same sort of pace as that in computer memory and speed, and the resolution is fast approaching that of 35 mm film.

Digital fundus photography has plenty of advantages:

- The image of the fundus can be digitally manipulated – that is, the colour balance can be changed to enhance different lesions, such as haemorrhages; it can also be enlarged and any significant lesions highlighted.
- The image does not move, so it can be studied at length, with colleagues or the patient directly.
- It can be sent down the line to an ophthalmologist, diabetologist or GP.
- It can be compared directly with a picture of the same eye taken earlier, to quantify progression of any lesions.
- Use of digital imaging make the audit of screening cheap and easy.

The bad news about the digital approach, however, is that:

- The digital image is monocular. It may well be that, in the future, a form of stereoscopic image could be digitally synthesised, using a combination of the laser scanning ophthalmoscope and the digital camera.
- The higher the resolution of the image, the brighter the flash needs to be. This can be a problem when the patient has cataracts, which tend to cause a lot of reflected glare and dispersion, making the picture ungradeable. As cataracts are a common added complication of diabetes, the number of potential ungradeable images must not be underestimated and is unlikely to be as low as the 5% required by the NSC. A recent audit by an optometric practice in Cheshire found that 12% of diabetic photographs were classed as ungradeable, but only 1% of eyes examined were ungradeable using BIO.[3]
- The better the quality of the image, the larger the file needed to store or transfer it. The currently recommended minimum pixel format is 1365 × 1000; an increase to 2160 × 1400 is recommended "as soon as technology permits".[4] In the latter format an uncompressed image would consume 9.3 Mb of memory, which in practice means that only 34 patients' photographs could be stored on a standard CD. At present, the image is required to be stored in an uncompressed form. Compression has not yet been fully addressed and must be a priority for the NSC.

What happens next?

I predict that by the end of the present decade the digital camera, not the direct ophthalmoscope, will be the primary method of viewing the fundus — not just for retinopathy screening but also for routine examination. As the quality of the digital image improves and the capital cost of the equipment comes down, and especially if litigation increases at the present rate, ophthalmologists and optometrists will have no option but to embrace the new technology. It will be interesting to see whether, by the end of 2007, 100% of diabetics will be offered retinopathy screening using digital photography.

REFERENCES

1. National Service Framework for Diabetes www.doh.gov.uk/nsf/diabetes
2. Preservation of sight in diabetes; a risk reduction programme www.diabetic-retinopathy.screening.nhs.uk/overview-of-screening-models.html
3. Taylor L, Riley A. Photographic study of diabetes. *Optometry Today* 2001 Oct 1 www.optometry.co.uk/articles2001
4. www.diabetic-retinopathy.screening.nhs.uk/photographic-model/index.html