Head-borne binocular indirect ophthalmoscopy is back

Bill Harvey tries out the latest variation of a classic method of ophthalmoscopy – the Keeler Spectra Plus – and finds much to recommend it.

I think it is fair to say that head-set binocular indirect ophthalmoscopes are rarely used in general optometric practice. It is also true to suggest that fewer students leave our universities with adequate skill in their use. But is this a merely an obsolete technique falling into obscurity? Or is it rather a reluctance to maintain one of the more specialised techniques which does have specific advantages in certain clinical scenarios? I would suggest the latter.

This article aims to offer an overview of the technique and its advantages (and disadvantages), before then describing my experience with a new headset BIO model, the Keeler Spectra Plus.

Binocular indirect ophthalmoscopy

● Advantages
There are several distinct advantages offered by BIO and these have driven its rise in popularity, primarily of slit-lamp BIO. The advantages include better clarity of retinal view through media opacities. As someone who primarily sees elderly patients, the increased quality of retinal image provided by BIO is significant. The reason for this improved vision is that the incident light path and reflected light path are separate, unlike with direct ophthalmoscopy. Interestingly, indirect illumination also has the benefit of exaggerating the appearance of pigmented lesions. It is very noticeable when first moving to indirect how much easier it is to notice naevi. If one looks at a choroidal naevus using the macular stop of direct instrument, the pigmentation is clearly seen outside the area of illumination but invisible under the beam. The intensity of the light source of BIO instruments also serves to improve the resolution of lesions (something patients do not always appreciate).

Stereoscopic viewing is useful in analysing the nature of certain lesions. Large areas of minimal elevation as may occur, for example, with a central serous retinopathy are often difficult to view but more easily detected with...
a stereo view. Also, three-dimensional structure is more easily assessed, such as the presence of flyover vessels at the optic disc in a glaucomatous patient.

A large field of view is usually cited as the main advantage of an indirect technique. Using a 20D condensing lens, a field of view of more than 30 degrees is realisable. For peripheral retinal examination, a wide field of view is preferable. However, too little magnification will lead to small lesions being missed. A good compromise is afforded by the Pan Retinal 2.2 (Volk), which delivers a 56 degree field and a magnification of 2.68X. A wide field is also essential for retinopathy assessment. Any multifocal lesion is more easily assessed as to extent and relationship of individual lesions if seen in one single view. Recently, many practitioners have started using the Optos Panoramic system of non-mydriatic scanning laser ophthalmoscopy which also offers an excellent field of view. It should be remembered that the image with this is a composite of two confocal light beam scans and is different to the ‘real world’ view offered by the headset BIO.

The view and magnification are effectively independent of the uncorrected refractive error of the patient. Adequate assessment of a high myope with a direct ophthalmoscope is difficult due to the large magnification and usually requires use of a contact lens or supplementary trial lens to gain a reasonable view. This is not necessary with a BIO technique.

Headset BIO is available to patients who cannot be sat at the slit lamp. Traditionally, this has usually been implied to be babies and infants, although anyone familiar with the ‘flying baby’ technique will know that slit lamps are still useful. Indeed, in this author’s experience, there is many an elderly patient who is unable to position themselves adequately at the slit lamp for any length of time. Headset BIO is a more flexible system and allows a view from many angles with the patient seated or lying prostrate comfortably (Figure 1).

The increased working distance is often quoted as useful in reducing patient to practitioner discomfort about their proximity to one another, but a good strong mint can do the job I find. More seriously, the working distance allows a lower power viewing lens (typically a 20D) to be used and therefore maintain a very large field of view. This means that with a fully dilated pupil (perhaps with tropicamide and phencyclidine used in conjunction) and appropriate lens positioning, the retina may be viewed way out to the periphery. Obviously this is useful in assessing the potential for retinal breaks and tears, or monitoring the extent of lesions such as retinoschisis, but may be further enhanced by the use of a scleral depressor with which tissues approaching the ora serrata are achievable.

Disadvantages

No technique is perfect and BIO does have some disadvantages. Obtaining a good view takes time and patience. It had been a couple of years since last using a headset, so for this trial I wrongly predicted the ‘riding a bike’ scenario and instead had to relearn the technique, admittedly a little more easily than when I first tried as a student. Control of the patient is key to gaining a good wide field image. Small movements of the light source, lens or patient eye are enough to cause massive reflections or loss of image. Another obvious point cited as a disadvantage, but one that is soon adapted to, is the fact that the image is inverted and reversed. Some practitioners get around this by turning their record card upside down before recording their findings, but familiarity soon makes this reinterpretation second nature.

The obvious correlate of a large field of view is a reduced magnification. Slit lamp BIO allows the use of lower powered condensing lenses which, when combined with the slit lamp magnification, allow perfectly good views of specific structures such as the disc and the macula. With the headset BIO and a 20D lens, magnification is not sufficient for a good disc assessment for example. However, the brightness of the light source gives a good enough resolution to make out vascular changes.

Using a headset BIO

The condensing lens captures the emergent light from the patient’s eye and presents this for binocular viewing. The larger the lens and the bigger the pupil the wider the field of view obtainable. The lower the condensing lenses’ power the greater the magnification and the smaller the field, as shown in Table 1. Higher-power lenses are held closer to the patient. The view is a bright wide field (about 10X wider than that of direct ophthalmoscopy). There is reasonable stereopsis and negligible alteration in magnification with the refractive error of the patient or examiner. There is an addition of +2.00D or +2.50D incorporated in the viewing system so that presbyopic examiners can view the aerial image comfortably.

Use of the Spectra Plus

The first obvious point to notice about the Spectra Plus is that the viewing

<table>
<thead>
<tr>
<th>Lens power, size</th>
<th>Working distance from cornea at apex (mm)</th>
<th>Magnification obtainable</th>
<th>Typical field of view (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15D, 52mm</td>
<td>72</td>
<td>4.11X</td>
<td>36</td>
</tr>
<tr>
<td>15D, 45mm</td>
<td>72</td>
<td>4.10X</td>
<td>31</td>
</tr>
<tr>
<td>20D, 50mm</td>
<td>50</td>
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<td>46</td>
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<tr>
<td>20D, 35mm</td>
<td>51</td>
<td>3.08X</td>
<td>34</td>
</tr>
<tr>
<td>Pan retinal 2.2, 52mm</td>
<td>40</td>
<td>2.68X</td>
<td>56</td>
</tr>
<tr>
<td>25D, 45mm</td>
<td>38</td>
<td>2.54X</td>
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<tr>
<td>25D, 33mm</td>
<td>39</td>
<td>2.48X</td>
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<td>28D, 41mm</td>
<td>33</td>
<td>2.27X</td>
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<td>30D, 43mm</td>
<td>30</td>
<td>2.15X</td>
<td>58</td>
</tr>
<tr>
<td>30D, 31mm</td>
<td>31</td>
<td>2.09X</td>
<td>44</td>
</tr>
<tr>
<td>40D, 40mm</td>
<td>20</td>
<td>1.67X</td>
<td>69</td>
</tr>
<tr>
<td>40D, 31mm</td>
<td>21</td>
<td>1.61X</td>
<td>57</td>
</tr>
</tbody>
</table>
unit is mounted on a sporty frame. The frame has been designed for multiple functions, for example holding the loupe system shown in Figure 2. I had only previously used the headset shown in Figure 3 which, for accurate usage, takes a good deal of time to set exactly to fit the head such that the best view is gained and to maintain stability on the head during use. I found the sports frame easy to fit and a simple backstrap held it firmly in place. The viewing unit is set onto the two pins before the bridge (Figure 4).

The power to the unit is from a portable battery pack (Figure 5) which is pre-charged from an overnight charging unit and, when fully charged, is sufficient to last a full day’s clinic. My previous experience had been with a wall-powered unit. The portability of the battery unit was very useful in a clinic with several bays, as might be the case in a hospital or a large practice.

With the rheostat on the battery pack (attached to my belt) set at its highest setting, a beam was trained at a wall around 40cm away. Each eyepiece may then be centred to view the circular patch of light by adjustment of the sliding inter-pupillary distance control (Figure 6). The height of the beam is adjusted by tilting the internal mirror using the lever on the side of the unit. It is essential with this technique that the eyepieces are central.

As with similar units, there is a choice of two filters along with the clear filter-free option most commonly used. A green filter is useful for looking for vascular anomalies (as well as in cases of particularly light sensitive patients) and a blue filter may be used for fluorescein angiographic viewing, a technique unlikely to be important to an optometrist it must be said.

Lengthy examination should be avoided if the eye has already been exposed to high light levels in the preceding 24 hours, for example during retinal photography. Both eyes of the patient should remain open throughout the exam (Figure 7). Screwing up one eye reduces the aperture in the remaining open eye. Patients may be lain flat if the chair allows it, but I managed adequate views on patients seated upright by simply moving myself into more doubled-up positions. If this was a technique to be used repeatedly for a long time, I would strongly recommend lying patients down to reduce the load on the practitioner’s back.

The superior periphery is easiest to examine first. This entails the patient looking up and the examiner standing 180 degrees in the opposite direction, namely towards the patient’s feet. Once the red reflex is seen, the lens is positioned with the steeper curvature of the biaxial lens facing the examiner. The side facing the patient has a silver or white band at the edge. Holding the lens parallel to the patient’s iris plane and a short distance from the cornea with the fingers steadied on the patient’s forehead or cheek, the anterior segment of the eye is seen through the lens with a red reflex in the pupil.

Moving the lens away from the eye, the fundus image fills the lens. If moved too far, the retinal image disappears and anterior structure is seen again.

The remainder of the retina may
be examined systematically, with the patient encouraged to move their eye and the lens being tilted to reduce reflection.

**Ease of use**
I found the set-up of the headset very easy, much easier than the more traditional helmet-style instrument. I was impressed by the fact that the unit was comfortable even after repeated uses. I like the portability of the unit enabling me to move around the patient with ease and making it easier to examine those patients not able to be lain out flat. The rheostat adjustment on my belt meant it was easier to interpret and respond to the patient’s signals of discomfort.

The image gained was easy to interpret and of a good enough resolution to visualise, for example, peripheral retinal degenerative changes. Dilation is important and this could limit use in a busy high street setting. Careful rheostat use and introducing the green filter while trying not to dwell on the posterior pole of the patient meant that poor response from patients was minimal. Positioning the lens at a constant 5cm from the eye and tilting to avoid bad reflections gave me a consistent and accurate view and initially took about four to five practice attempts to be reasonably confident of my view. The low magnification means I will continue to use my Super 66D for maculopathy and my SuperField for diabetic retinopathy, but would seriously consider headset BIO as my main technique for many patients requiring a good peripheral retinal scan, for example when complementating a search for tobacco dust in a suspect myope.

● For further details on the Spectra Plus, contact Keeler on 01753 857177

**Figure 6** Adjusting the eyepiece to centre the image

**Figure 7** The patient must keep both eyes open

**Figure 5** The portability of the battery unit was very useful