INSTRUMENT TRIAL

Measurements on the move

Bill Harvey tries out a novel smart phone adaptation that allows lens measurements to be taken wherever you are

Knowing about a patient's existing correction is essential to the process of refraction. Not only will it indicate the extent of any change in refraction, it also should influence the final choice of correction prescribed to ensure patient comfort. If refraction was merely the prescribing of lenses to correct the actual lower order aberrations (spherical and cylindrical on axis error), then we would have been replaced by autorefractors years ago.

Accurate lens measurement is also important when discussing what existing correction is best for any individual task, and forms an essential part of patient education – especially for those who may be confused by which of their current spectacles are for a particular purpose. This is something all those who undertake domiciliary visits will recognise. The housebound are often the very same people who may need some instruction as to what the various, and often numerous, pairs of spectacles they own are best used for. Often for similar reasons, they are also the people most likely to offer ambiguous or inconclusive responses during subjective refraction. So reliable objective measurements, both of their refractive error and of their current corrections, are essential.

PORTABILITY

Accurate lens measurement is (or should be) fairly straightforward in practice. I say should be as, it may surprise some readers, assessment of a graduate optometrist's focimetry skills during the station-based final assessment for qualification is notorious for yielding the poorest marks. Manual focimeters (figure 1), employing Drysdale's principle, and the more modern automated electronic counterparts are capable of vertex power measurements and marking up of the optical centres so allowing centration distances and any worked prism to be measured. Lens marking also allows the assessment of the vertex power and worked prism of progressive lenses, though the position of and progression of power around the near addition measurement point, combined with a lack of awareness of the design of the lens which might require the front rather than the back vertex power to be measured for any given lens, makes the near reading often difficult. Indeed, it is fair to say, most practitioners rely on lens markings to confirm the reading addition of a progressive lens.

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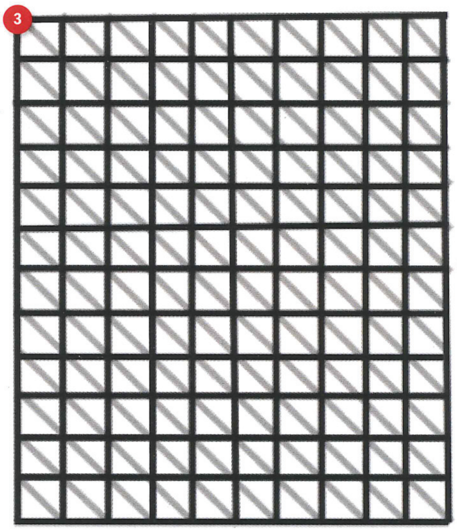

For the domiciliary setting, some practitioners use the same manual focimeter as in the practice setting but, as these can prove bulky to carry and usually require a mains power source, a range of portable alternatives are available. When I have undertaken domiciliary low vision assessments, the kit I am given always contains such an instrument which, though definitely portable, is still somewhat bulky and dependent on the regular change of batteries meaning spares always need to be carried too.

At a global level, in order to offer eye care to the depressingly large number of people worldwide currently without it, a portable system of lens measurement has to be made available.

Any lens measurement technique that improves on portability is worth a look at in my view and so I was most interested in the new Netrometer (UK distributor BIB Ophthalmic Instruments) which is, in essence, an adapted smartphone with stand. Obviously this passes the portability test, but is it accurate?

NETROMETER

The Netrometer system consists of a dedicated Samsung Galaxy S4 smartphone, preloaded with appropriate software, and a stand into which it clicks and under which a spectacle lens may be held

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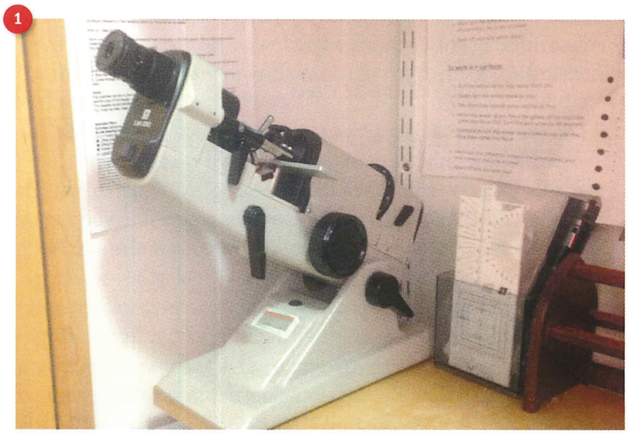

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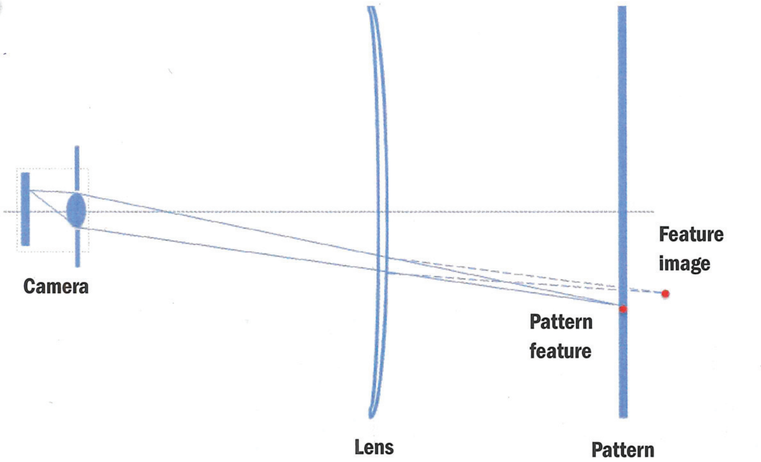

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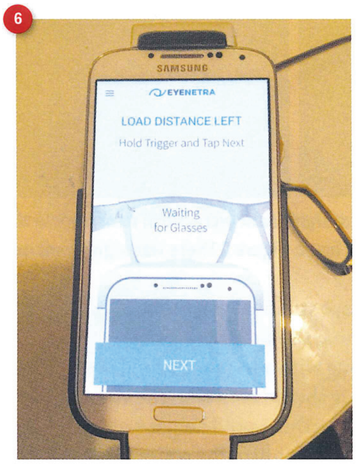

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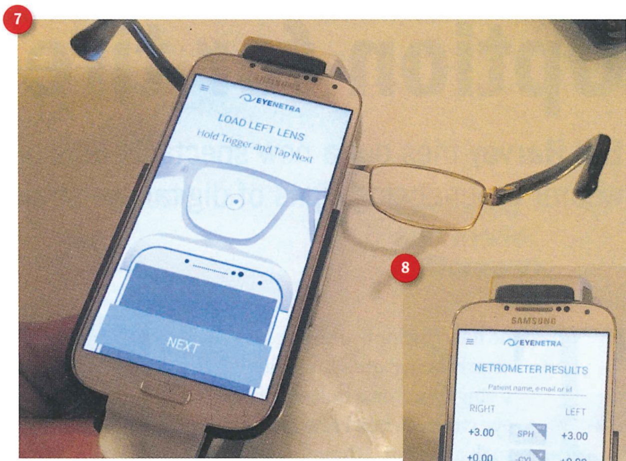

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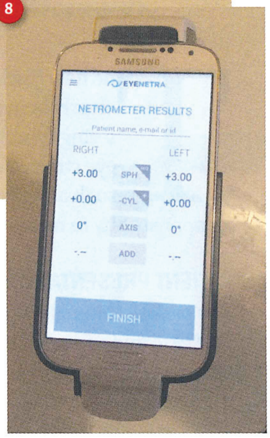

in place and positioned correctly for measurement (figure 2). The unit uses the camera of the phone to determine the sphere and cylinder of any lens placed correctly and does this using a process currently awaiting patent and with the very sci-fi name 'Neflectometry.'[1]

Details of this process are hard to come by but, in essence, it seems that the system relies upon the phone taking a photo of a target (figure 3) and the distortion of this induced by an intervening lens can be used to calculate the power of that lens (figure 4). In some ways the method is analogous to the point spread function used by aberrometers.

When the phone set within the stand is first switched on and the embedded app activated, the screen offers the choice of measuring single vision or progressives (figure 5), though the latter is still under beta testing. After making the selection, tapping of the button also sets up the instrument by taking an image of the grid target without the spectacle lens in place. If this is not done, measurement is not possible. Once so calibrated, the screen then asks you to position the left lens of the spectacles to be measured (figure 6).

I first tried out the system using single vision lenses: first spheres and then sphero-cylinders. At the point of positioning the spectacles, a small circle appears on the screen and you need to manoeuvre the lens under the phone such that a small blue dot, representing the optical centre of the lens, falls within it (figure 7). To hold the spectacles in position, squeezing a trigger on the stand unit brings down a grip on to the lens to hold all in place. When centred correctly, the circle turns blue and the lens can be measured by pushing the 'next' button. I found it easiest to centre the dot before pulling the trigger, and this was especially the case with progressive lenses.

The screen directs you to centre the right lens of the spectacles in place and again takes a reading (figure 8). At the end of the process, the screen changes to display the results (figure 9) and these can be annotated and saved with a patient identifier.

ACCURACY

The instrument measures spherical lenses easily, quickly and with accuracy. Sphero-cylindrical prescriptions are equally accurately measured but with one obvious design flaw. There is no rest to press the lower frame rims against and so you have to rely on your own judgement to ensure the frame is horizontally aligned. Failure to do this accurately results in axis error which, for high cylinders, would be significant.

The progressive lens measurement was less easy to undertake. For very short corridor or narrow eye frame mounted lenses, it proved near impossible to assess the near addition. Larger eye frames and longer corridor lenses were easier and I achieved some accuracy (within 0.25D on the distance sphere and cylinder with the same proviso regarding the axis and within 0.50D on the addition). Putting this in perspective, however, the ability to quickly assess a pair of spectacles 'on location' (and with the option of reading off the addition from the lens) was impressive and would in many situations be more than adequate. It will be interesting to see any adaptation once the beta test phase is complete.

SUMMARY

This nifty little instrument is perfectly good at assessing most common single vision and bifocal lenses and offers a reasonable ball park assessment of most progressive lenses. It would benefit from a horizontal guide to improve cylinder axis accuracy. Also, if it had the ability to dot up the lenses when centred, I am sure it could easily be adapted to measure (or at least allow estimation) prisms. I certainly recommend that anyone undertaking domiciliary visits on a regular basis should have a look at the Netrometer.

- Further information from bibonline.net

REFERENCE

1 Pamplona VF, Mohan A, Oliveira, MM, Raskar, R. NETRA: Interactive Display for Estimating Refractive Errors and Focal Range. ACM Transactions on Graphics 29 (4), 77:1 - 77:8, 2010.