INSTRUMENTS

Distanced refraction

Between lockdowns, **Bill Harvey** takes a look at a new instrument from Topcon that has clear potential for both minimising patient contact time and allowing remote measurement of refraction

Since the appearance of Covid-19 in the UK, we have all become well used to the importance of minimising infection while offering eye care. Along with maintaining adequate personal protective equipment (including screens on instruments) and surface disinfection, we are all very conscious of two further essential ways of preventing virus spread:

- Staying as far away from a patient as possible
- Minimising the time spent with a patient

The challenge has been to adhere to these rules without any impact on the effectiveness and accuracy of testing. Whether assessing the health status or the visual and refractive status, each element of a routine eye examination brings its own challenges. Refraction is a key part of the examination and the importance of a quick and accurate objective assessment followed by a subjective assessment, as socially distanced as possible, has never been greater.

Of course, automated objective refraction has been with us for decades and, with modern autorefractors showing good repeatability, it is possible in some countries to use autorefractor booths to obtain a final spectacle correction without the involvement of a clinician or technician. That said, the lack of adequate in-test checking, no account of any influence from binocular status, and errors of accommodation and varying blur interpretation are all common reasons why objective assessment alone can be problematic. Perhaps more importantly, the complete absence of any interpersonal communication between tester and tested makes it impossible to correct error, to pre-empt any possible adaptation challenges or to introduce final correction adjustments to suit a specific demand (night driving, unusual viewing distance and so on). These factors underline the need for a subjective element to refraction and explain why autorefractors have not taken over.

TABLE 1

Objective measurement

- **Refraction measurement range**
  - Spherical refractive power; -25DS to +22DS
  - Cylindrical refractive power; 0DC to -10DC
  - Cylinder axial angle; 1° to 180°
- **Corneal curvature measurement range**
  - Corneal curvature radius; 5.00mm to 10.00mm
  - Corneal refractive power; 67.50DS to 33.75DS (conversion value when the corneal refractive ratio is 1.337)
- **Minimum measurement unit**
  - Spherical/cylindrical refractive power; 0.12DS/C
  - Cylinder axial angle; 1°
  - Corneal curvature radius; 0.01mm
  - Corneal refractive power; 0.12DS
- **Display of measured value;**
  - Displayed on the screen of the operation controller
- **Minimum measurable pupil diameter**
  - Φ2.0mm
- **PD measurement range**
  - 50mm to 80mm
- **Minimum PD measurement unit**
  - 0.5mm

This year sees the introduction of a guided binocular refraction unit from Topcon that may have the answer to safe and accurate refraction. When, on the eve of the November lockdown, I heard that a prototype of the new instrument was available at Topcon HQ, I thought I would take a look and dragged my 'bubbled' son along as an accommodatively challenging guinea pig.

THE CHRONOS

The Topcon Chronos (figure 1) is a free-standing unit combining;

- An autorefractor with keratometry
- Acuity chart and target system
- Computerised phoropter unit with automated alignment

With a footprint of less than a metre square, the unit is easily incorporated into the busiest of practices, while the adjustable table and unit

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TABLE 2

Subjective measurement

- **Refraction measurement range**
  - -18.00DS ≤ Equivalent spherical power ≤ +18.00DS
  - -8.00DC ≤ Cylindrical power ≤ 0.00DC
  - Cylinder axial angle 1° to 180°
  - Horizontal prism; ±15.0 Δ
  - Vertical prism; ±2.5 Δ
- **Minimum measurement unit**
  - 0.25DS/0.25DC/ 1° / 0.1 Δ
- **Test distance**
  - Far/near-point test distance can be set between 25cm and 6.096m
- **Visual acuity measurement range**
  - 0.05 to 1.6 decimal
- **Charts**
  - Visual acuity charts, spherical power correction charts, astigmatism correction charts and binocular function charts
- **Background luminance**
  - 155±15 cd m^{-2}

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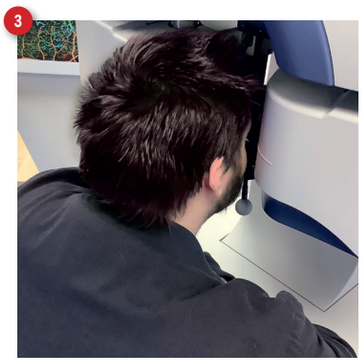

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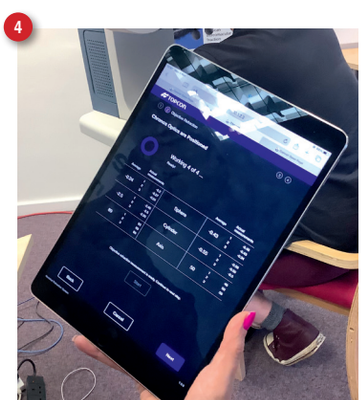

alignment make it accessible to all, including wheelchair users.

Essentially, the Chronos combines the benefits of accurate autorefraction (see table 1) with the flexibility of automated phoropter systems (see table 2) into a networked instrument that may be operated from a remote software platform, either on a tablet within the practice or online from a computer anywhere in the world. Name your distance.

Patient positioning is easy (figures 2 and 3), the instrument automatically aligning eyepieces with the patient. This can then be further refined by an operator as required.

The key to the system is the Topcon software system known as SightPilot. This can be run from a tablet (figure 4) within practice and earshot of the instrument, or remotely. During our visit, a member of staff hundreds of miles away was able to conduct a refraction via laptop (figure 5).

SightPilot can be pre-programmed to go through a number of simple 'yes/no' style steps, from objective or from lens meter results, each linked to the relevant test chart (figure 6) and allowing a staff member with minimal training to undertake the testing. Throughout the stepped process, whenever there is any unexpected responses or variability (such as when my son's accommodation fluctuated), the system will flag up when an eye care professional should take over. If this does not occur, then the

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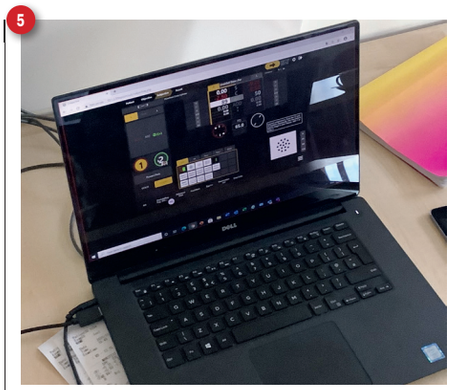

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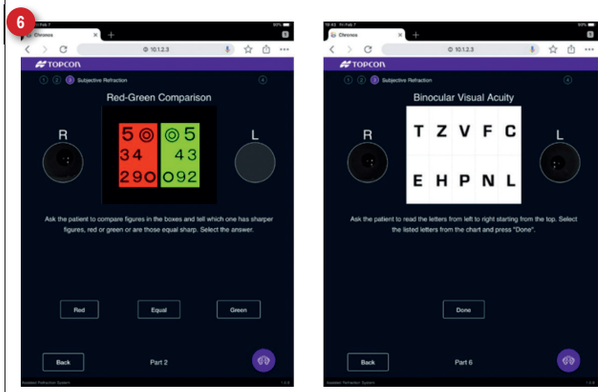

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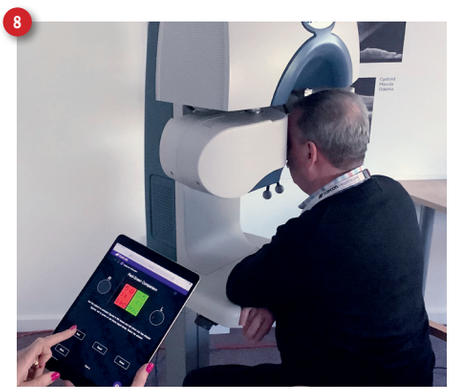

ECP need simply to look at the end result data and carry out any final check of comfort, balance or adaptation as they see fit. In this way, as with so many of our current testing protocols with the OCT or a fields screener, data gathering may be delegated while the ECP maintains control of the final interpretation, adaptation and prescribing. Results are then streamed, printed (figure 7) and saved.

THE FUTURE?

Any instrument boasting accurate and efficient refraction that allows minimal contact time and offers the prospect of remote testing is worth taking a look at. Any concerns of deregulation are tempered by the Chronos which still ensures the ECP has the final say. Indeed, I would not be surprised to see such units being used in remote testing centres one day for a centrally located ECP to then analyse, refine and prescribe in the way we might also see with other data gathering systems such as those being looked at for OCT. Topcon boss Andy Yorke was so confident about the accuracy of the Chronos, he let me test his eyes (figure 8).

- Further information at www.topcon-medical.co.uk.