INSTRUMENTS

A thorough examination

Bill Harvey takes the opportunity to run a complete test using the latest Visionix instrument

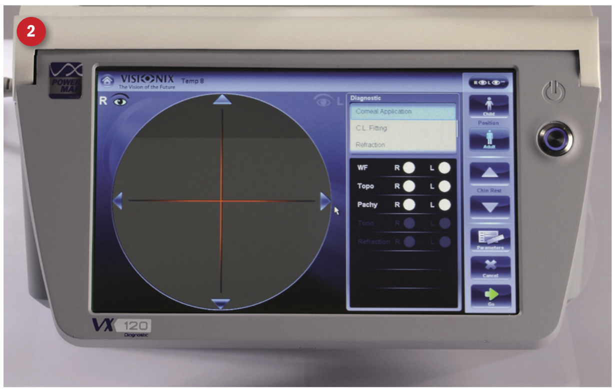
I was able to try out the new dry eye assessment option recently made available for the latest incarnation of the Visionix, the 120+ (see *Optician* 07.02.2020). While I had the chance, I took the opportunity to assess a few patients using the full armoury of tests on offer, and here present some of the results achieved.

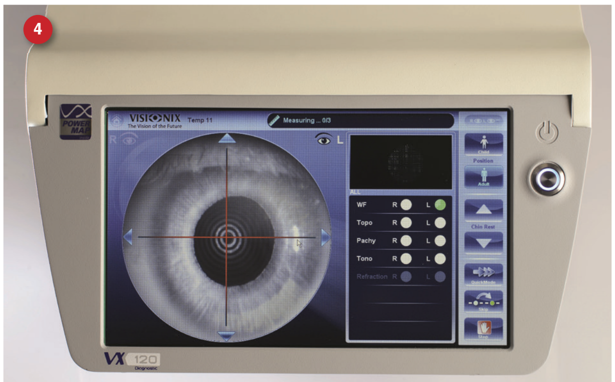
MULTIFUNCTION

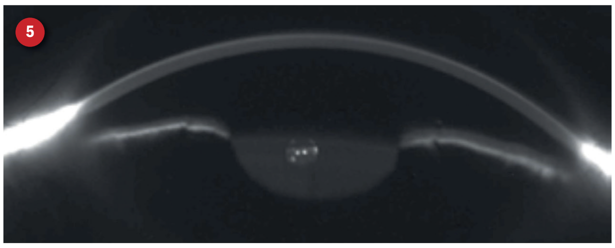
The main selling point of the Visionix 120+ (figure 1) has to be the wide range of tests it is able to undertake. After entering the usual patient data, or selecting an existing patient on the database, you can then select from a range of diagnostics, each with set associated tests. For example, as shown in figure 2, selecting the 'corneal application' tells the machine to undertake wavefront analysis (aberrometry), topography and pachymetry. 'Refraction' triggers autorefraction and wavefront analysis. It is also here where the new 'dry eye' function' is selected and which is a standalone battery of tests.

Having positioned the patient at the machine at the correct height, I selected the full battery of tests. From this point on, the machine pretty well does everything for you, with minimal operator or patient demands. The sequence of tests is as follows:

1 Wavefront assessment; the machine uses three sweeps of an infra-red incident beam to measure the refractive error, calculate the higher order aberration profile and use retroillumination to detect cataract. To minimise accommo-







dation and pupil error, the patient views the now familiar image of a balloon (figure 3). The contrast and bright colours encourage fixation even with higher errors yet to be corrected, and there are perspective clues from the contours of the road that imply, Ponzo-style, that the target is far off. The patient eye is seen on the operator screen (figure 4) and the pupil is easily centred by a tap on the screen before the measurements are taken.

2 Scheimpflug image capture; the patient is asked to look between two blue fixation lights while the machine captures a cross section image of the entire anterior chamber (figure 5). Named in honour of an Austrian army officer Theodor Scheimpflug, who first refined methods of reducing distortion in early aerial photographs at the start of the 20th century, the technique is accurate enough for individual measurements to be taken from the resultant image. These include anterior chamber depth, anterior angle, and corneal thickness across the cornea.

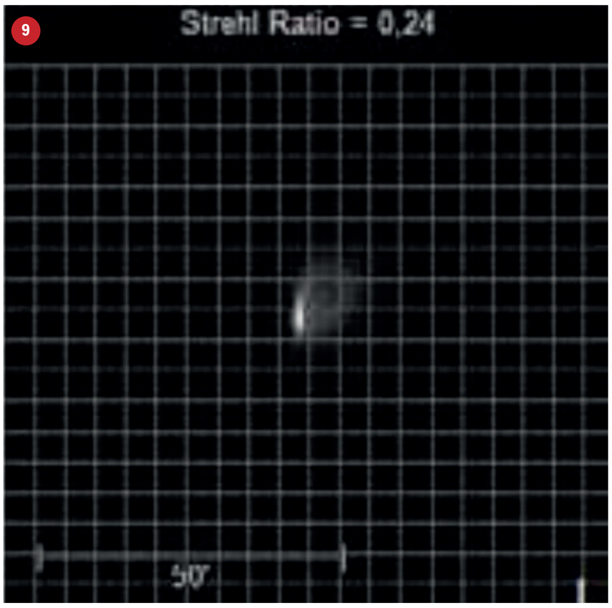
3 Topography; it is now that the characteristic rings on the patient side of the instrument switch on, providing a Placido ring image on the cornea from which topographic information is derived.

4 Non-contact tonometry; finally, the machine moves vertically some way until a mirror is aligned to allow control of three consecutive air puffs, the force of which needed to applanate the cornea then being converted into intraocular pressure readings.

The whole process takes just over a minute for each eye, assuming the patient is suitably compliant, and the key results are immediately available both on screen and via a print out strip. Data can also be exported to external drives, obviously with all data protection rules being obeyed, or directly to linked instruments on a practice system.

REFRACTIVE ANALYSIS

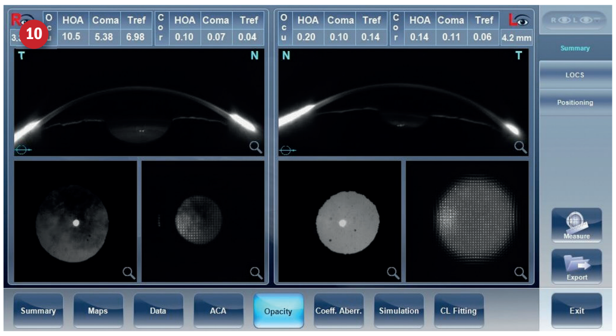
The summary screen for a patient is shown in figure 6. The top box reveals the average refractive error (for a proscribed back vertex distance, usually defaulting to 12mm) and notes its value for

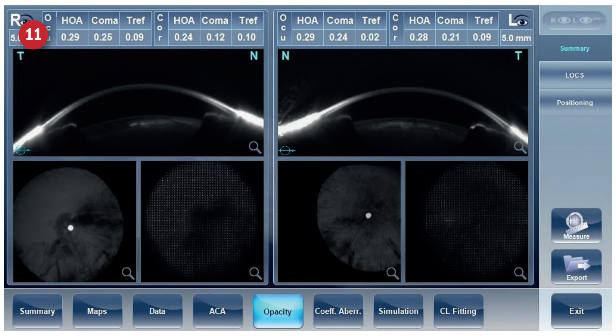


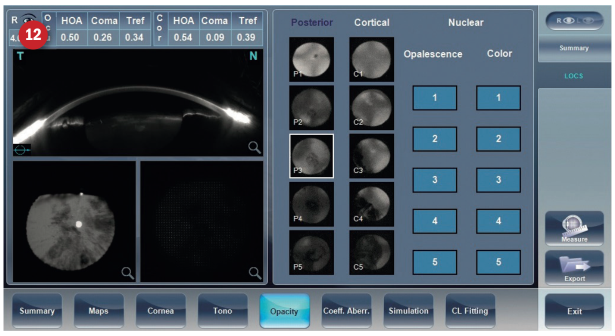
both mesopic and photopic conditions, useful where there may be a night time refractive shift. There is also a large 'E' acuity target which can be set to show the patient, if they did not know already, what blur their error causes if left uncorrected. More importantly, it can be used to show the clarity with full spherocylindrical correction and further still if higher order aberrations (HOAs) are also included. This can be quite dramatic for those few people where the HOAs are large. This may be seen in figure 7, the summary screen for an early keratoconic. Note how the blur is significantly greater for the larger pupil error.

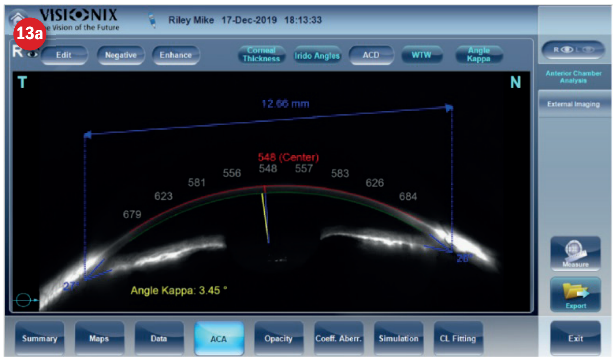
The summary screen also shows key topographic data, k readings in either dioptres or millimetres, pachymetry values, a small anterior chamber view, and tonometry readings – more of this later.

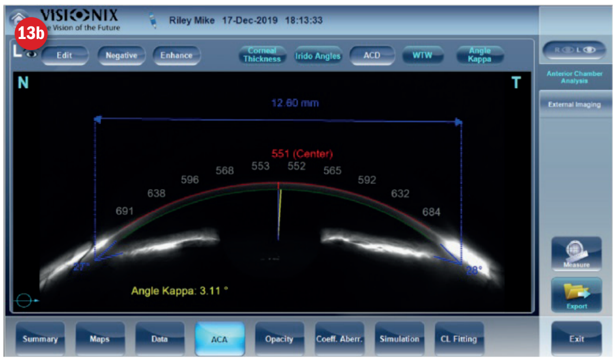
Across the bottom of the screen are buttons allowing further ➔











analysis of the data. The 'coefficient of aberration' tab displays each of the main higher order aberrations graphically, the bar chart view shown in figure 8, but also viewable as a modulation transfer function graph. The HOAs are measured using a Hartmann Shack system, and it is possible to see the point spread during measurement (figure 9).

CATARACT

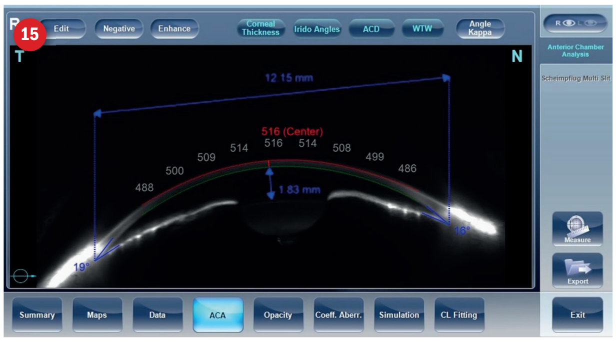
Any lens opacity may be viewed by selecting, unsurprisingly, the 'opacity' tab. Figure 10 shows a patient with nucleosclerotic changes in the right eye. This is clearly seen by the retroillumination view (bottom right), but the impact on light transmission is also shown (bottom right) along with the cross-sectional view. Figure 11 shows the same output for a patient with bilateral cortical lens opacities. For consistency of data, there is also the option to record a grade for the cataract at any one sitting (figure 12) which can be useful in monitoring.

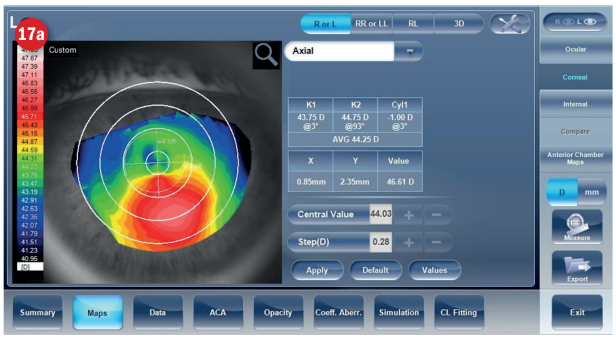
ANTERIOR CHAMBER

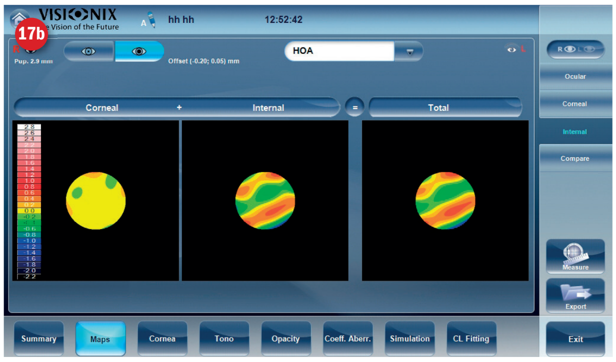
Figure 13 shows the right anterior chamber (13a) and the left (13b) for a high myope. The wide angles can easily be seen as well as pachymetry values across the extent of the cornea. Note also that angle kappa is displayed. Angle kappa is the angle between the visual axis and the pupillary axis. It is clinically important to the refractive surgeon because patients, especially hyperopes, have a large angle kappa and the centre of the pupil is no longer the point through which a fovea-centric ray of light passes. I am a hyperope and, as predicted, my AC image showed a large angle (figure 14). This can be adjusted down to zero after data capture and all the related data are adjusted automatically. I have also attempted to measure my anterior angle by use of the software callipers. This can be done automatically, but is usually more accurate by manual adjustment on a magnified image of the angle. Figure 15 shows a patient with narrow angles, while figure 16 shows a patient post-LASIK and with a consequently thin cornea.

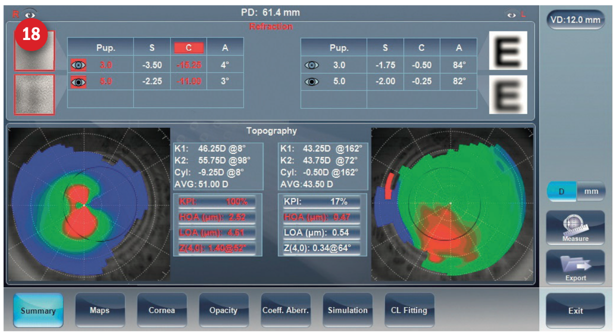
TOPOGRAPHY

The advent of myopia management and a renaissance in rigid lens fitting makes a topographer a very attractive piece of kit to any modern practice. Indeed, when I have spoken with colleagues about the Visionix, the topography function rates high among the









reasons for buying the instrument. Topographic data can be displayed in a variety of ways, including a range of maps (figure 17), summary data with refractive analysis (figure 18) and numerical data (figure 19). These data are for a keratoconic patient.

TONOMETRY

The tonometry readings are shown as the average of three, though outliers may be disregarded. The machine also uses the pachymetry data to show a corrected IOP value (figure 20). The algorithm used is that from Professor Michael Doughty, the cornea specialist that readers from Glasgow Caledonian may remember.

SUMMARY

Being able to acquire such a wealth of data in such a short time and with a single, low footprint machine, is obviously attractive for a busy practice. Making full use of the data, by post-test analysis, takes a little practice but the effort is worth it. Furthermore, the design of the machine means that, I suggest, further functionality is likely to appear in the coming years.

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