

# INSTRUMENTS

## Altogether now

**Bill Harvey** tries out the new Ocular Surface Analyser which promises a complete assessment and analysis of ocular surface health in just a matter of minutes

I think we can safely say that dry eye disease is no longer considered by any practitioner as a single disease entity which can be addressed with a single drop. Indeed, if it were needed, the recent TFOS DEWS2 reports have emphasised that the condition has a wide variety of causes, both external and internal, and expresses itself in a range of ways, from corneal staining and tear break up time reduction through to tear osmolarity changes and fluctuations in inflammatory markers within the tears. The condition itself may be of an evaporative or aqueous deficient nature, and usually a combination of the two in a ratio that might be anywhere along a spectrum of combinations of the two. Furthermore, the condition may have significant numbers of signs with few symptoms and vice versa.

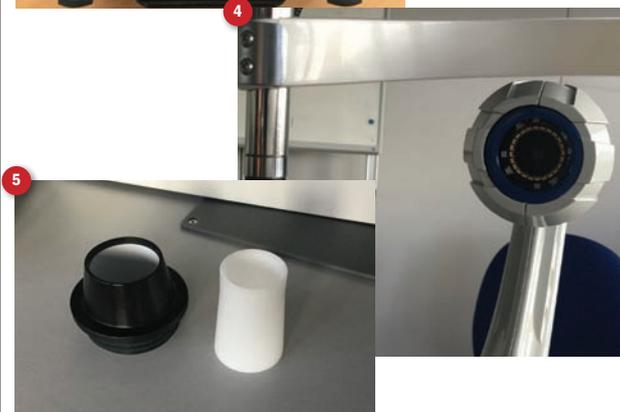
No wonder, then, in order to provide an effective management plan, which is likely to involve a number of components to tackle the problem, it is necessary to carry out a range of assessments, to look at each result as part of an overall profile, and then to decide on the best remedial approach. It should also be possible to review the patient regularly, be able to easily access their profile, and then see how effective any intervention has been and decide upon any adjustment to the care plan, either by looking at the patient's compliance or by change one or more of the interventions.

The Ocular Surface Analyser (OSA) has been designed to meet this need and I was able to try it out recently (thanks to UK supplier Grafton Optical for loan of the unit).

### THE OCULAR SURFACE ANALYSER

#### The hardware

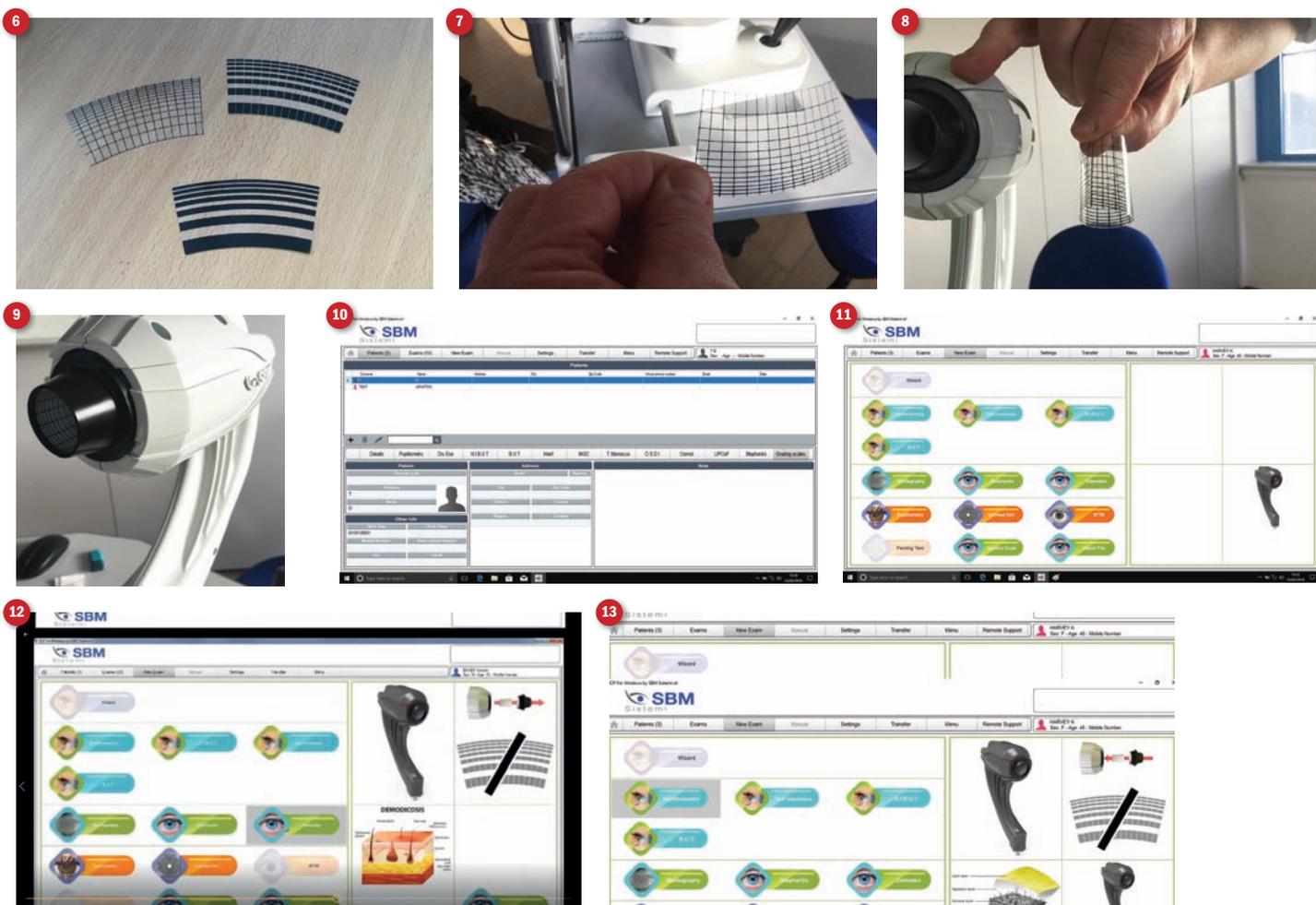
The OSA is essentially a digital imaging system (figure 1) that can be fitted into the central pivot hole (figure 2) of any slit-lamp. The unit has two links (one USB2 and the other USB3) to link with any laptop with the ports and onto which the licensed software has been downloaded (you pay for the unit and a license for software on one laptop). The unit, wiring and the linked laptop are



easily contained within a carry case (figure 3) making the system portable between clinics.

The unit itself comprises a six-megapixel capture system capable of acquiring stills and movie formats. It has both manual and autofocus options, though adept slit-lamp operators will opt for manual focusing, and has both infrared and white/blue LED outputs.

The patient capture end of the unit is shown in figure 4. For certain functions, a magnifying lens can be screwed into this, for example higher magnification assessment of the lids when looking for Demodex. Other tests require a plastic cone (figure 5) to be added and, within this, one of three grids may be inserted (figure 6). These are:



- A thick grid for tear break up (figure 6, top right)
- A fine grid for tear quality and surface regularity (figure 6, top left)
- A Placedo ring grid for corneal integrity (figure 6, bottom)

When required, the grids are rolled into a cylinder and placed within the viewing cone with the ends placed at the 12 o'clock position (figures 7, 8 and 9).

**The software**

Opening the program takes you to a list of existing patients and an option to input new patient data. There is no normative database as such so no restrictions on the number of fields first included beyond name and date of birth (figure 10). Highlighting a patient and clicking on 'new exam' takes you to the main control view for any individual assessment sitting (figure 11 and 12). This displays the number of tests available (and this is likely to be updated in future – for example, tear ferning is not yet active but is likely in future). The Italian software designers have grouped the tests into colour-coded sections as follows:

- Tears (light blue)
  - Inteferometry
  - Tear meniscus
  - Non-invasive break up time
  - Fluorescein break up time
- Lids (green)
  - Meibography
  - Blepharitis

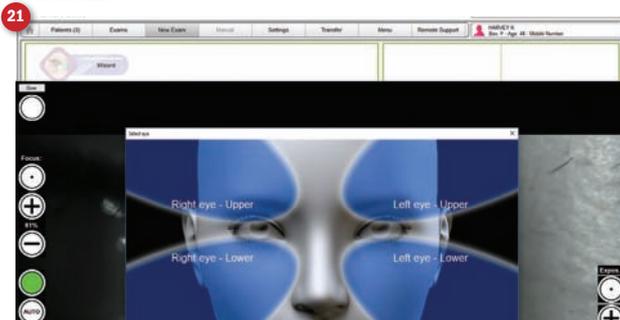
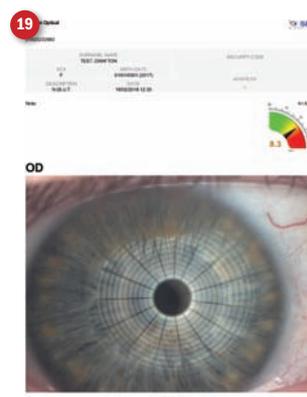
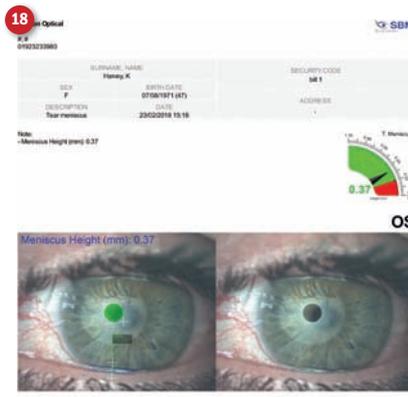
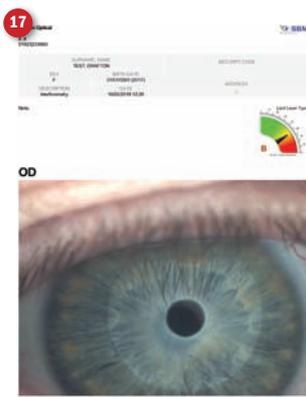
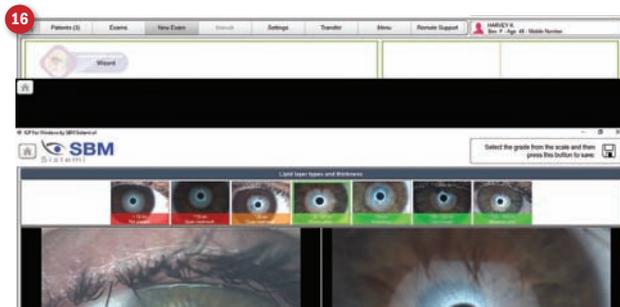
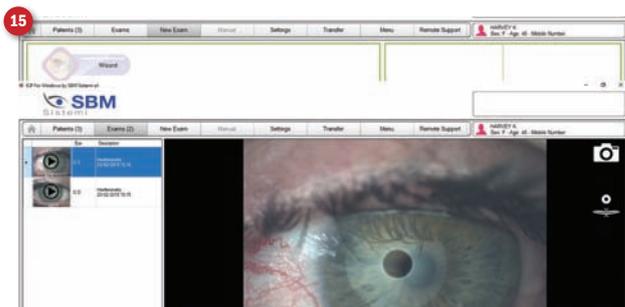
- Demodex
- Other (orange)
  - Pupillometry
  - Corneal deformation
  - 'white-to-white' – what we would call horizontal visible iris diameter

There is also an option to capture a video of anterior assessment (labelled as 'generic exam') and to import external files from other systems which might also be analysed ('import file').

At this point you might reasonably ask about other essential data for dry eye assessment, such as tear osmolarity or the score achieved with an acknowledged symptom questionnaire. These data are added at the analysis stage, as we shall see later, and can therefore be included in an overall report of the dry eye status of any patient.



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### Data capture

Interferometry – when clicking on this test, the screen shows you the correct set up for the imaging unit (figure 13). In this case, no grid is required but the white cone should be maintained in the head. You next select which eye is to be viewed first (figure 14) and then a live view of the eye appears. The image then needs to be focused such that, after each blink, interference fringes are clearly seen on the tear film. You then record a section of video, a couple of blink's worth should suffice, and each time this is done for each eye, the video is saved for further analysis (figure 15). An example of a video is available with the online version of this article.

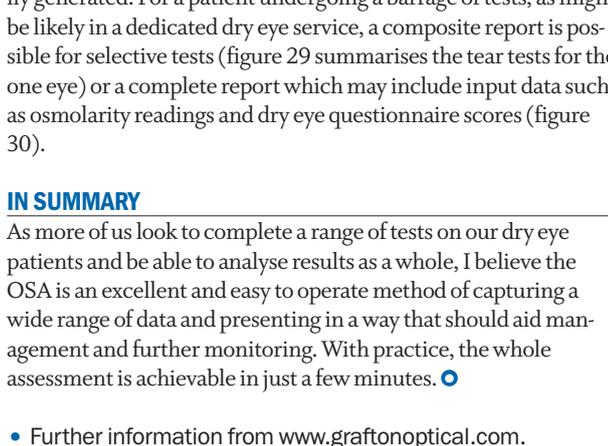
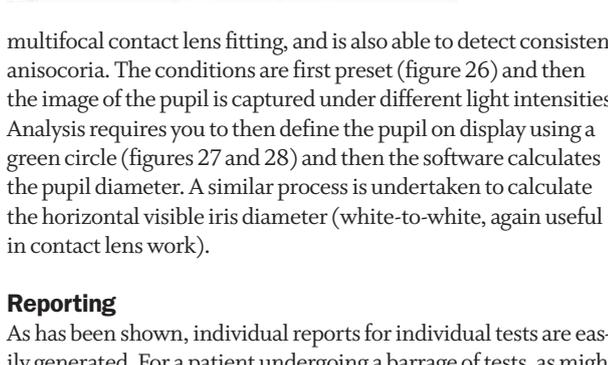
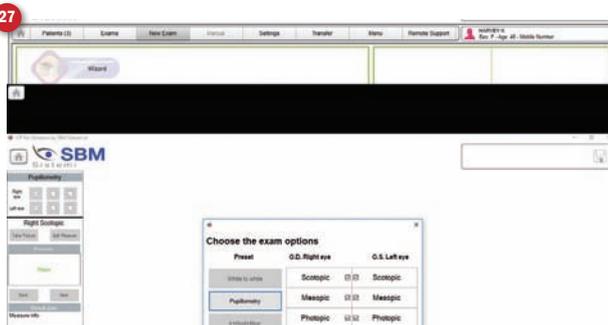
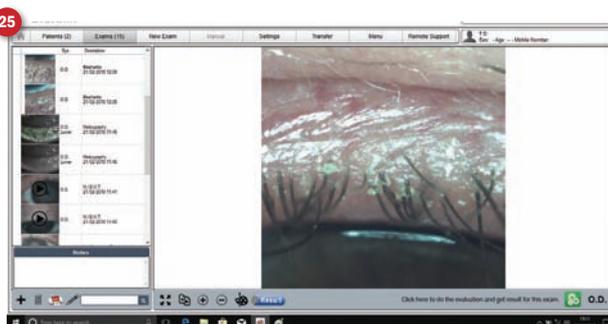
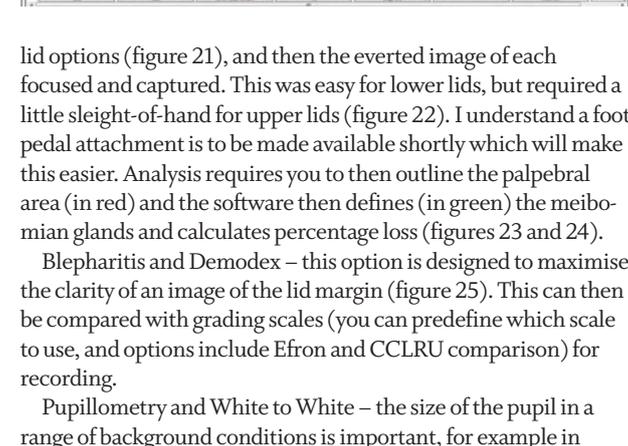
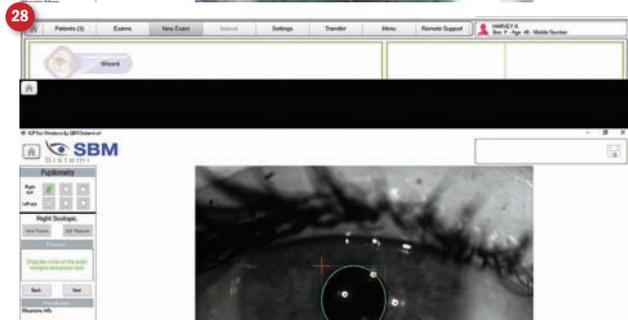
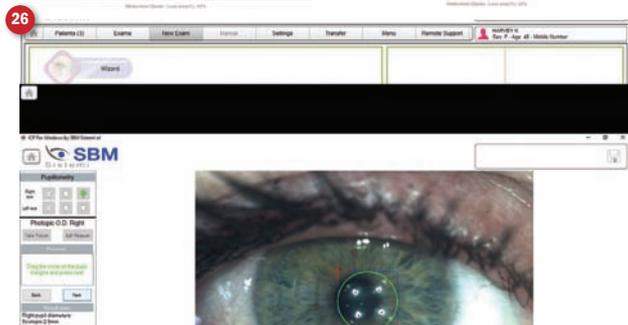
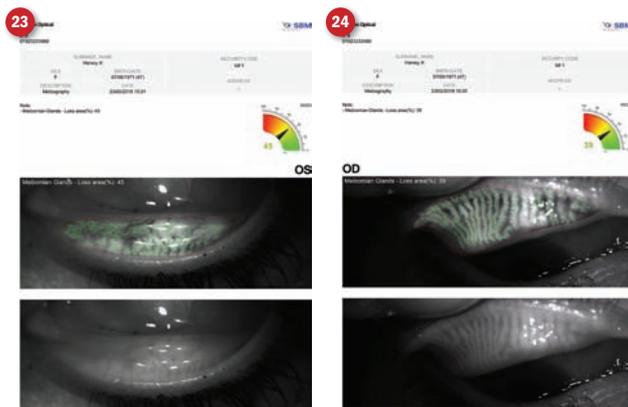
Analysis allows you to select a particular segment of this video and display it onscreen next to sample representations of differently fringed tear films (figure 16). You then select which of the sample videos best reflects your patient and the software will generate a report accordingly (figure 17). The report shows a sliding scale representing the normality of the chosen appearance. In the case report shown, this is a 30nm close meshwork pattern, just approaching surface degradation.

Tear Meniscus – this can be achieved from a still captured yourself under the same settings as interferometry, but is also possible from a still from the interferometry video – indeed the software asks you if it should do so, and this does save some time during patient assessment. From this still image, in order to calibrate the image, you have to align a central green circle with a black

circular target on screen and then adjust two callipers to align with the edges of the tear meniscus. This calculates the meniscus height for you (figure 18).

Break up time – this is first, more accurately, achieved by including the grid within the cone and videoing the appearance of the grid as it appears projected upon the anterior eye until there appears areas of deformation on the pattern. The time for this to occur is then calculated as the break up time and a report generated (figure 19). For break up time, no grid is required and blue light is used allowing break up time to be measured in the normal way (figure 20). For accuracy, some time is needed here to get the image as clear as possible and a brighter intensity with an externally applied yellow absorption filter is helpful. A similar process is undertaken using the Placido rings grid to check for any corneal surface deformation.

Meibography – this is initiated by first selecting one of the four



lid options (figure 21), and then the everted image of each focused and captured. This was easy for lower lids, but required a little sleight-of-hand for upper lids (figure 22). I understand a foot pedal attachment is to be made available shortly which will make this easier. Analysis requires you to then outline the palpebral area (in red) and the software then defines (in green) the meibomian glands and calculates percentage loss (figures 23 and 24).

Blepharitis and Demodex – this option is designed to maximise the clarity of an image of the lid margin (figure 25). This can then be compared with grading scales (you can predefine which scale to use, and options include Efron and CCLRU comparison) for recording.

Pupillometry and White to White – the size of the pupil in a range of background conditions is important, for example in

multifocal contact lens fitting, and is also able to detect consistent anisocoria. The conditions are first preset (figure 26) and then the image of the pupil is captured under different light intensities. Analysis requires you to then define the pupil on display using a green circle (figures 27 and 28) and then the software calculates the pupil diameter. A similar process is undertaken to calculate the horizontal visible iris diameter (white-to-white, again useful in contact lens work).

### Reporting

As has been shown, individual reports for individual tests are easily generated. For a patient undergoing a barrage of tests, as might be likely in a dedicated dry eye service, a composite report is possible for selective tests (figure 29 summarises the tear tests for the one eye) or a complete report which may include input data such as osmolarity readings and dry eye questionnaire scores (figure 30).

### IN SUMMARY

As more of us look to complete a range of tests on our dry eye patients and be able to analyse results as a whole, I believe the OSA is an excellent and easy to operate method of capturing a wide range of data and presenting in a way that should aid management and further monitoring. With practice, the whole assessment is achievable in just a few minutes. ●

- Further information from [www.graftonoptical.com](http://www.graftonoptical.com).