The KAT goes digital

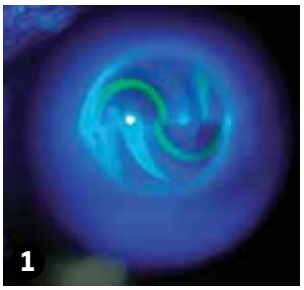
Bill Harvey looks at the new digital version of the popular Keeler Applanation Tonometer (KAT)

All entry level optometrists need to be competent in the use of an applanation tonometer. This has been the case for some time now and complete reliance upon non-contact tonometry is no longer an option. This GOC competency requirement was introduced prior to the guidelines suggested by NICE stating the referral decisions relating to ocular hypertension need to be qualified by a contact technique. This possibly helped to reinforce the view that the contact technique is more accurate than non-contact methods. But is this actually true?

Accuracy

The Goldmann applanation tonometer (GAT) is another of those instruments to which the term 'gold standard' is routinely applied. It is the method used in ophthalmology throughout secondary care and is therefore the technique which anyone wishing to monitor intraocular pressure with a view to refer to secondary care should also use. However, to say it is more accurate than the non-contact technique is overstating the case. The technique relies upon a force being applied to an area of cornea such that it flattens it and the force applied may be related to the pressure from within the eye pushing back on the probe. The well-known relationship of force = pressure x area may apply if we assume the cornea has no rigidity (it does) and is dry (it is not). These two sources of error are compensated by choosing an area of flattening (7.354mm^2) where the surface tension attraction from the wet cornea may balance the rigidity outward push from a cornea of known thickness. Goldmann seems most accurate for a cornea of 520 micron thickness.[1]

Obviously, the thicker the cornea, or the more rigid its nature, the higher the apparent intraocular pressure reading. Non-contact techniques suffer from these two errors too and most authorities agree that for higher IOP measurements, non-contact methods offer higher result values. Knowledge of corneal thickness and rigidity may allow the IOP measurement from Goldmann to be adapted to a more realistic value. Furthermore, the elevated IOP values when measuring IOPs in the mid-20s mmHg or more make it essential that primary care practitioners reassess any non-contact measurement found to be high with a contact method before referring (if this is the single reason for referral).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Digital applanation

This leaves us with one often understated source of error. Goldmann relies on the subjective assessment of the relationship between two green semicircles which often move relative to one another, are often difficult to see with complete clarity, vary depending on the amount of fluorescein instilled and drained from the tears of any one individual, and which respond in position relative to each other with a delay after the force applied is changed (Figure 1). Subjectivity always introduces variation and it is accepted that inter-user variation in measurement exists even between the most experienced of practitioners.

Anything that may reduce this variation helps. Slit-lamp mounting makes readings from the Goldmann more repeatable than those from the hand-held Perkins equivalent. Use of a known dose of fluorescein helps, as does a standard approach to the technique (for example avoiding heavy pressure from the fingers in maintaining the palpebral aperture).

Standard Goldmann uses a wheel to register the force applied (Figure 2) which makes fine judgement of IOP equivalent force tricky. This is where the new digital Keeler Applanation Tonometer (KAT) earns its merit – I got there eventually!

I have used previous digital incarnations of the Goldmann and had some concerns about their robustness so was reassured to see the digital KAT is as solid and resilient as the standard. In fact it is identical in every way to the KAT except there is an LED display instead of the marks on the wheel (Figure 3). The display is activated by a simple push of a button and, by holding the button for three seconds, the user may decide on whether to include a decimal point which allows a change in accuracy from ± 1mmHg (Figure 4) to ±0.1mmHg (Figure 5).

Findings

I found it much easier to read from the LED display. I also used the instrument for a pre-reg assessment and found it much easier to monitor performance with the LED display clearly visible. Assuming the robustness is as good as I believe, this is a useful development. A previous digital design included an indicator of when the cornea was actually being applanated and this would be a useful further adaptation to the KAT. But I would certainly recommend this instrument for anyone looking to invest in a contact tonometer. Farewell to the clunky wheel!

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References

1 Ehlers N, Brausen T, Sperling S. Applanation Tonometry and central corneal thickness. *Acta Ophthalmol* (Copenh), 1975; 53: 34-43.

● More details at www.keeler.co.uk