# Glaucoma -Tonometry

## Intraocular pressure measurement

**Figure 1** Goldmann tonometer mounted on a slit lamp

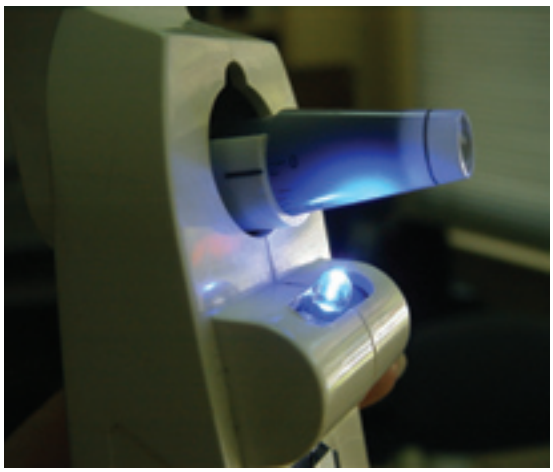

**Figure 2** Perkins tonometer with LED illumination

### DESCRIPTION

Some of the available methods of measuring intraocular pressure are:

- **Goldmann tonometry**. Considered to be the 'gold standard'. It is a slit-lamp mounted applanation tonometer and is a robust and reliable instrument
- **Perkins tonometry**. Uses the same Goldmann applanation probe in a portable hand-held instrument. An LED light source can provide greater brightness
- **Non-contact tonometry**. Air-puff tonometers are objective, do not require anesthetic or fluorescein and avoid the risks of corneal abrasion, drug reactions or infection
- **Proview eye pressure monitor**. An approximate method suited to home use
- **Pascal DCT**. A new objective instrument that may be less affected by corneal thickness or related factors
- **Tono-Pen XL**. The smallest, most portable, tonometer.

### CENTRAL CORNEAL THICKNESS

The Ocular hypertension treatment study (OHTS) showed those patients with thin central corneal thickness (CCT) were more likely to develop glaucoma, both because of the IOP underestimation and also the CCT formed an independent risk factor.

Thicker CCT causes an overestimation of IOP. A thin CCT may occur naturally, as well as with keratoconus or after refractive laser surgery. There is not a single accepted algorithm for adjusting IOP values for CCT. One approach is to simply use CCT as a risk factor. The OHTS suggested the following for ocular hypertensive patients:

- High risk: ≤555 microns
- Moderate risk: ≥555 to ≤588 microns
- Low risk: >588 microns.

Average CCT with ultrasound pachymetry is around 545 microns (95 per cent range: 476-612 microns).

A rough IOP correction value is: ±1mmHg per ±20 microns of corneal thickness. Another guide in use is: ±7mmHg per ±100 microns of corneal thickness.

### OTHER PATIENT FACTORS

- **Body position and diurnal curve.** Night-time IOP may be 3-4mmHg higher in normal patients and up to 10mmHg in glaucoma patients, which may relate to the patient's supine posture, as well as an effect of closed-eye corneal thickening (oedema) on the measure.
- **Lid pressure or blepharospasm** can increase the IOP. If the subject voluntarily widens his palpebral fissure to accommodate the tonometer, IOP may increase.
- **A tight collar or necktie** can increase the steady state IOP.
- **Patient anxiety** may result in the Valsalva manoeuvre (forced breath-holding), which is known to increase the IOP from 5-20mmHg. IOP rises within 30 seconds of breathholding or forced expiration, and takes 60-120 seconds to recover. Forcing an obese patient behind the slit lamp, repetitive coughing by the patient, or asthma from timolol have been implicated in increasing the IOP.

### USER FACTORS

- **Multiple measures or excess contact time.** Applanation of the cornea displaces a small amount of aqueous, depending upon the pressure used and the aqueous facility of outflow. Excessive applanation may make the IOP falsely low.
- **Retracting the eyelid.** When measuring the IOP, care should be taken not to apply pressure to the globe, for example, when retracting the upper eyelid.
- **Goldmann and Perkins.** Examiner bias may affect results. Start with the pressure below the expected level, to avoid excess applanation effects. Avoid excess or inadequate fluorescein. Conduct the test so as to minimise the subjective aspects.

The full series of these articles will be available in the book *Posterior Eye Disease and Glaucoma A-Z* by Bruce AS, O'Day J, McKay D and Swann P. £39.99. For further information click on the Bookstore at **opticianonline.net**


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