Non-contact Tonometry

Dr. Merine Paul, MS

Anyone who has undergone the procedure of conventional IOP measurement will vouch for the fact that it is a very uncomfortable procedure. Comfort and the fact that contamination between patients is minimized is what makes non contact tonometers, “the coolest!”. It uses an “air puff” to measure IOP, but is different from the pneumatic tonometers where there is contact between the tonometer and the patients eye.

Principle of NCT

The NCT was the brainchild of Grolman and was introduced in 1972. A puff of air creates a constant force, which momentarily deforms the cornea. It is difficult to determine the exact nature of corneal deformation, although it is postulated that the central cornea is flattened at the moment the pressure measurement is made.

Types of NCT

1. Table mounted – Xpert NCT (Fig. 1)
2. Hand held - Pulsair tonometer from Keeler (Fig. 2)

Parts of the Instrument

- Alignment system
- Opto electronic applanation monitoring system
- Pneumatic system

Alignment System

- Allows the operator to optically align the patients cornea in three dimensions – axial, vertical and lateral
- In present models the air puff is automatically triggered when alignment criteria are satisfied.

Monitoring System

This consists of a transmitter, which directs
a) A collimated beam of light at the corneal vertex
b) a receiver and detector, which accepts only parallel and coaxial rays, reflected from the cornea

Pneumatic System

Generates a puff of room air which is directed against the cornea.

At the moment the central cornea is flattened, the greatest numbers of reflected rays are received, which is recorded as the peak intensity of light detected. The time from an internal reference point to the moment of maximum light detection is converted to IOP based on prior comparison with readings by Goldmann tonometry. In the newer version the force of air required
to achieve peak light detection is the measured variable when air puff is automatically triggered on meeting the alignment criteria (Fig. 3).

**Technique of IOP Measurement**

**Manual**

Patient observes an internal target while the operator aligns the cornea by superimposing a reflection of the target from the patient’s cornea on a stationary ring. During this time the light from the transmitter is reflected from the undisturbed cornea. When the cornea is aligned the operator depresses the trigger. The air puff is released which depresses the cornea and the IOP is displayed in a digital format.

**Automatic**

From a distance of about 25 cm the operator aligns the cornea with the instrument looking through an eyepiece. Maintaining alignment, the instrument is moved closer to the patient’s eye. At a distance of 15 m from the eye an image of a bow tie appears (Fig. 4). On centralizing this image the pulsair automatically fires the air puff. IOP is shown as a digital display.

**Fallacies With NCT**

The time interval for an average measurement is 1 to 3 ms (1/500th of the cardiac cycle) and is random with respect to the phase of the cardiac cycle, so that the ocular pulse becomes a significant variable and it cannot be averaged as with other tonometers. Glaucomatous eyes have significantly greater range of momentary fluctuations in IOP. It is recommended that more than 3 readings within 3 mm Hg range be taken and averaged as IOP.

**Accuracy**

Comparisons against Goldman applanation tonometers indicate that NCT is reliable with in normal IOP range. The reliability is reduced in the higher pressure ranges and is limited by abnormal corneas and poor fixation. One study indicated that central corneal thickness has a greater influence on NCT than on Goldmann tonometry.
Advantages

- comfort
- no contamination
- no chance of corneal abrasion
- no reactions to topical anaesthetics

- of value in mass screening and in studies of newer antiglaucoma drugs

Caution

There have been reports of sub epithelial air bubbles after repeated use of NCT.

NCT is a safe and reliable method of measuring IOP. Caution to be used when measuring glaucomatous eyes as lower pressure may be recorded at IOPs above the normal range as in abnormal corneas. Overall a handy tool in a busy ophthalmic OP.

References

2. Shields MB The non contact tonometer: its value and limitations, Surv. Ophth. 1980; 243:211

HUMOUR IN OPHTHALMOLOGY

This Happened in My Practice

Dr. R.R. Varma

The year was 1981. And the place, the headquarters of a ‘backward’ taluq in South Malabar. The author with a fresh D.O. was in charge of a nonexistent Ophthalmology Department of the Taluq HQ Hospital. Even though the hospital didn’t have any ophthalmic facilities, ‘home practice’ was moderately heavy.

One afternoon the very handsome and brand new son-in-law of a prominent local family walked into my consultation room, accompanied by his obviously distressed wife and a puzzled brother-in-law. The presenting complaint was sudden and severe defective vision of both eyes. His external eyes were normal and so were his fundi and other parameters. But his vision was less than 6/60 in either eye. I was totally at a loss, vaguely thinking of bilateral Occipital infarcts and other diagnosis of poor prognosis. After consoling his wife, who was on the verge of tears, I put some Drosyn in his eyes and asked him to wait, more to get some time to think than anything else.

When I came out to call another patient, I saw his eyes following Kanaran, the coconut-tree climber all the way up the tall palm. And suddenly I remembered that he did not walk with the typical ‘narrow-field gait’. When his turn came, I called him in – alone.

Even though he hemmed and hawed initially, when I got tough he confessed. This boy, handsome like a Bollywood hero was illiterate. His looks coupled with a ‘Gulf job’ had mesmerised his wife’s family. The poor chap was at his wits end and begged me not to give him away. I consoled him by telling that Malayalam language had only 51 alphabets and he could master it in a short time. So I prescribed some innocuous eye drops and vitamin tablets and asked him NOT TO READ FOR THREE WEEKS (of course in presence of his relatives).

The next time he came, he had a confident smile on his face and a knowing one on his wife’s.