CORNEAL THICKNESS
High-speed Scheimpflug tonometer CCT readings lower than other technologies

by Howard Larkin in Milan

Central corneal thickness (CCT) measurements taken with the Corvis ST (Oculus) non-contact tonometer are significantly lower than readings obtained with the Orbscan IIx (Bausch & Lomb) and Pentacam (Oculus) devices, Mukesh Kumar, senior optometrist, Narayana Nethralaya Eye Hospital, Bengaluru, India, told the XXX Congress of the ESCRS.

While readings from the Corvis correlate well with the other two devices, the numerical differences are large enough that they may not be interchangeable in clinical practice, he cautioned.

Mr. Kumar examined 104 keratoconic eyes in 52 patients using all three devices and compared the results. Mean age was 24, ranging from 14 to 32 and mean refractive error was -4.0 D cylinder, ranging from -3.0 to -8.0. Patients with previous corneal surgery or acute hydrops were excluded.

The Corvis ST incorporates a high-speed Scheimpflug camera that captures horizontal images of the cornea at a rate of 4,300 frames per second to record corneal deformation produced by an air puff. This enables measurement of corneal thickness as well as corneal stiffness and viscosity.

However, in Mr. Kumar’s study Corvis consistently underestimated CCT in keratoconus eyes compared with Orbscan IIx, which makes multiple slit-lamp images of the anterior chamber using a camera moving horizontally, and Pentacam, which creates a 3D model of the anterior chamber using a rotating Scheimpflug camera. Mean Corvis measurements were 429.4 +/- 50.4 microns, about six per cent lower than the 456.4 +/- 54.3 measured by Orbscan and about five per cent lower than the 452.0 +/- 57.0 measured by Pentacam.

There was significant linear correlation among measurements from all the devices, Mr Kumar reported. Between Pentacam and Orbscan, the correlation r-value was 0.782; between Pentacam and Corvis 0.807; and between Corvis and Orbscan 0.921, all significant at p<0.01.

Non-contact advantages
Mr Kumar emphasised the usefulness of measurement of CCT in keratoconus, noting that it is used for diagnosis, follow-up and planning for surgical procedures. Accurate thickness measures are essential for implanting Intacs and planning corneal surgery.

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“Contact ultrasound is the most common method of measuring corneal thickness,” Mr Kumar said. But it has drawbacks including infection risk, making non-contact measurement attractive.

While Corvis CCT data may not be interchangeable with measurements by other devices, the instrument generates other data that may be highly useful for assessing and following ocular conditions. These include deformation amplitude, length and velocity, which correlate with corneal biomechanical properties of stiffness and viscosity.

For glaucoma, the dynamic information on corneal deformation and recovery it provides enables accurate calculation of intraocular pressure that takes into account differences in corneal dimensions and biomechanical properties. This removes the uncertainties inherent in Goldmann applanation tonometry, which assumes all corneas respond similarly to external pressure.

Combined with topographic and tomographic data, Corvis may also increase the sensitivity and specificity of screening for patients at risk of ectasia (Renato A et al. Int Ophthalmol Clin. 2011;51:11-38). Overlaying images from weakened corneas deforming over those from normal corneas can help spot early keratoconus even in eyes with normal topography.

The device, introduced in 2010, also may be useful for objectively measuring the results of corneal cross-linking on corneal biomechanical properties. Its potential for enabling customised cross-linking and refractive procedures has also been discussed.

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