



Early diagnosis

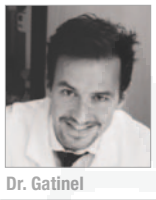
Analysis promising for keratectasia

Diagnostic platform combines anterior surface topography, corneal tomography data

By Cheryl Guttman Krader

Reviewed by Damien Gatinel, MD, PhD

Paris—An analysis combining information from anterior Placido topography and corneal tomography obtained using a proprietary corneal imaging diagnostic platform (Orbscan II, Bausch + Lomb) has shown high sensitivity and specificity for discriminating between Placido negative eyes with forme fruste keratoconus (FFKC) and normal controls, and shows promise as a clinically useful tool for early diagnosis of keratectasia, said Damien Gatinel, MD, PhD.



Dr. Gatinel

“The detection of eyes with the earliest manifestations of keratectasia remains an important challenge in preoperative screening for laser vision correction,” said Dr. Gatinel, assistant professor of ophthalmology, Rothschild Ophthalmology Foundation, Paris. “Currently, most diagnostic and classification criteria for keratectasia programs are based only on anterior cornea curvature data. However, with the current thresholds used in these automated analyses, anterior surface topography may not

Take-Home Message

Anterior surface topography is usually relied on to detect keratoconus, but it may not be sensitive enough to detect keratectasia-susceptible corneas. Findings from discriminant analysis suggest a combination of anterior surface topography and corneal tomography data (Orbscan II, Bausch + Lomb) may be a better tool.

be sensitive enough to detect all the keratectasia-susceptible corneas.

“Our investigation shows that in eyes where there is no suspicion of keratoconus based on objective analysis of the anterior topography, evaluation of corneal tomography data may sometimes reveal an underlying ectatic condition,” he added.

Designing appropriate studies

Answering the question of what technique is superior for early detection of keratectasia-susceptible corneas requires well-designed investigations. These must use a pertinent clinical model and appropriate statistical methods, Dr. Gatinel said.

“These studies must include corneas with known keratectasia susceptibility, and to achieve maximum specificity and sensitivity, they must use discriminant analysis that evaluates the method’s performance in separating the study groups and so minimizes false negatives and false positives,” he explained.

Borrowing from Stephen D. Klyce, PhD, who stated that the fellow eye of a patient with unilateral keratoconus should be considered as having FFKC, Dr. Gatinel suggested that the fel-

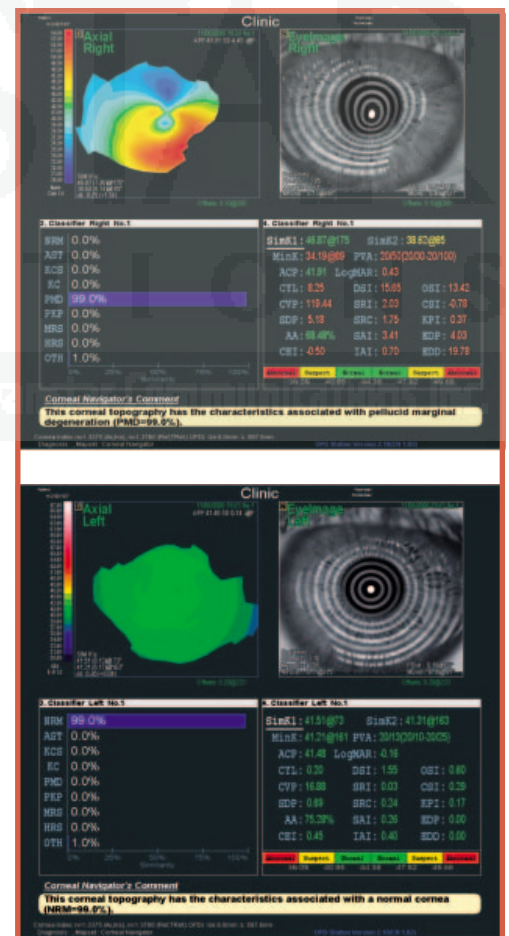


Figure 1 This patient (male, aged 19 years) has a very asymmetrical form of keratoconus. Despite advanced keratectasia on the right eye, all the Placido-based indexes (Klyce/Maeda indices) are within the normal range on the left eye. The left eye of this patient has a forme fruste keratoconus, and can serve as an interesting clinical model to investigate the possibility that elevation-based (posterior surface, tomography) and viscoelasticity measurements may increase the sensitivity and specificity of early subclinical keratoconus detection.

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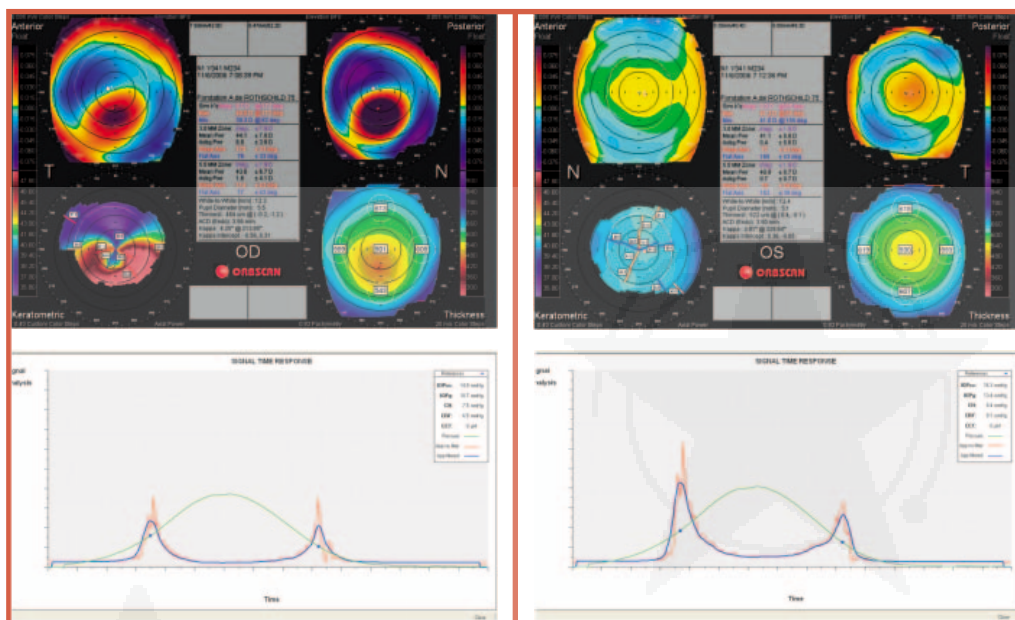


Figure 2 In the left eye, the posterior elevation is slightly increased, the rate of peripheral flattening and central thinning are borderline or slightly outside the normal range. Eventually, discriminant analysis using a total of 38 values derived from elevation topography and tomography allowed identification of this eye as keratectasia susceptible. Despite large topography differences, corneal hysteresis and resistance factor are comparable. The shape of the waveform signal is altered in both eyes (lower and larger applanation peaks). (Figures courtesy of Damien Gatinel, MD, PhD)

low “normal” represents the perfect false negative model for discriminant analysis studies.

“As Dr. Klyce said, although the FFKC eye has no clinical findings of keratoconus and is Placido negative, it has genetic susceptibility to keratoconus and is considered to have sub-clinical keratoconus,” he said.

Two studies

Dr. Gatinel described two studies incorporating these principles to evaluate early keratectasia diagnosis using 1) anterior Placido topography and corneal tomography data from the Orbscan II and 2) time-domain waveform-derived parameters obtained using a non-contact applanation tonometer (Ocular Response Analyzer [ORA], Reichert). The results indicated the superiority of the Orbscan-based approach that offered high sensitivity and specificity (92% for both), whereas the technique using the ORA had reasonably high sensitivity, but poorer specificity.

Both studies compared both eyes from 40 patients with unilateral keratoconus (KC eyes and FFKC eyes) and 70 normal controls selected from eyes that remained normal 2 years after LASIK. Both the FFKC and control groups were Placido negative.

For the Orbscan study, comparisons between groups showed statistically significant differences between the Placido-negative FFKC eyes and the normal controls in the thinnest point value, eccentricity index (irregularity at 3 and 5 mm), and posterior elevation at the thinnest point. The percentage of variation of the ante-

rior curvature from the thinnest point to the periphery and the percentage of increase in thickness from the thinnest point to the periphery were also significantly different between the two groups such that the FFKC eyes showed faster flattening and thickening toward the periphery compared with the normal eyes.

Discriminant analysis using all of these parameters resulted in an area under the receiver operating curve of 0.98, sensitivity of 92.5% and specificity of 92%. A model using fewer of the parameters resulted in significant loss of specificity and sensitivity, according to Dr. Gatinel.

Dr. Gatinel noted he has been collaborating with David A. Luce, PhD, of Reichert, in the development of a keratectasia detection score using ORA measurements. An analysis using the seven most discriminating measurements from within a set of 38 waveform-derived parameters had sensitivity of 84.6% and specificity of 78.3% in differentiating between the 40 FFKC eyes and the 70 normal controls, he said.

“This is better than with Placido topography alone, and can provide additional useful information, but still may not be optimal for replacing topography,” Dr. Gatinel concluded. **OT**

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Dr. Gatinel receives lecture fees from Nidek and Reichert.