Air Pressure–Induced Iridocornea Contact in a Patient With Primary Angle Closure Observed With a Dynamic Scheimpflug Analyzer

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Purpose: To report air pressure–induced corneal deformation and iridocornea contact in eyes with primary angle closure (PAC) during intraocular pressure (IOP) measurement performed using a novel noncontact tonometer.

Methods: A single case report.

Results: We report a patient with bilateral angle closure. One eye had acute PAC and the other had PAC. The latter was evaluated by the movements of the cornea and iris during IOP measurement using a noncontact tonometer. During the examination, the corneal endothelium and the iris came into contact at the mid-peripheral pupillary area in the left eye with PAC during the corneal reaction to an air puff. In contrast, the corneal endothelium in the pupillary area did not come into contact with the iris.

Conclusions: Although we observed only 1 case and there could be limitations in its interpretation, IOP measurements using a noncontact tonometer may create mechanical stress on the corneal endothelium in eyes with PAC with a very shallow anterior chamber.

Key Words: intraocular pressure, primary angle closure (PAC), Scheimpflug-based noncontact tonometer, iridocornea contact, mechanical stress

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Measurement of intraocular pressure (IOP) with air pressure is the popular screening method, and noncontact tonometry is a well-known noninvasive method. The Corvis ST (Oculus Optikgeräte Inc., Wetzlar, Germany) was introduced recently as a novel Scheimpflug-

based noncontact tonometer. This device increases the air pressure puffed onto the cornea in proportion to time and stops the air puff as ordinal noncontact tonometers do. The corneal deformation can be optically detected. In the Corvis ST, a built-in high-speed camera records the ocular movements, while a slit light illuminates the eye through the apex during application of the air puff. For each measurement, the camera uses a sequence of 140 Scheimpflug corneal images. Complete visualization of the deformation process can be seen in video output. The parameters are displayed after internal calculation from the captured video images.^{1,2} The device calculates the time required to flatten the corneal area after the air is puffed. The air pressure to flatten the cornea is calculated by its calculated time, and the IOP is obtained.

We report the results using the Corvis ST. A video shows that the pupillary margin of the iris came into contact with the inner corneal surface in an eye with primary angle closure (PAC).

CASE REPORT

The patient was a 60-year-old man with bilateral angle closure. The right eye with acute PAC had undergone laser iridotomy at another hospital. He was referred to our hospital for further treatment. During his first examination at our institution, both eyes had a best-corrected visual acuity of 18/20; the IOP values were 12 and 8 mm Hg in the right and left eyes, respectively. The patient instilled topical pilocarpine hydrochloride 1% once daily in the left eye. Both eyes were highly hyperopic (+15.0 D), and his Shaffer angle-closure grades were 1 bilaterally. The right eye had a low

FIGURE 1. Video snapshots of the Corvis ST. A, An air puff is delivered to the center of the cornea. B, An air puff is delivered slightly above the cornea.

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FIGURE 2. The anterior chamber depth of the left eye measured using the Pentacam. In Supplemental Digital Content 1 (<http://links.lww.com/IJG/A60>), the video shows iridocornea contact in this eye with primary angle closure.

central corneal endothelial cell count ($1419/\text{mm}^2$) and a short axial length (16.17 mm). We observed the patient because of the high risk of complications during additional surgery in the right eye. Although the central anterior chamber depth (ACD) in the right eye measured with a Scheimpflug-based corneal topographer (Pentacam HR; Oculus GmbH, Wetzlar, Germany) was 1.42 mm, the IOP remained stable during observation. We did not perform additional interventions in the fellow eye because of low central corneal endothelial cell count ($1432/\text{mm}^2$), short axial length (16.11 mm), and shallow ACD (1.21 mm), and there were no increases in the IOP or peripheral anterior synechia index under observation with instillation of eye drops.

We evaluated the air pressure-induced corneal deformation using the Corvis ST. During evaluation, we observed contact between the corneal endothelium and iris in the videography of the left eye. When the central cornea of the left eye became concave as a result of the air puff, the inside surface came close to the iridolens diaphragm and the ACD became shallow. Although the central corneal endothelium remained a distance from the center of the

lens, the mid-peripheral area and the pupillary margin of the iris came into contact with the inner corneal surface (Figs. 1A, B, and Supplemental Digital Content 1, <http://links.lww.com/IJG/A60> shows the iridocornea contact in this eye with PAC). The area of the iris that was in contact with the corneal endothelium seemed to be around the anterior chamber where the Pentacam displayed the shallowest depth (Fig. 2). On the basis of our observation, the corneal endothelial cell count did not change substantially.

DISCUSSION

The IOP status is a fundamental parameter in glaucoma management. Measuring the IOP with air pressure is a popular screening method because it is noninvasive.² The current case showed for the first time that measurements performed in an eye with a shallow angle may be associated with potential risk to the corneal endothelium. After the air was puffed onto the corneal surface, the cornea gradually flattened. The backward movement of the iridolens diaphragm lowered the pressure of the anterior chamber. The corneal concavity then progressed again and there was partial contact with the rebounded iris. Goldmann applanation tonometry is not associated with this problem because it uses lower pressure.^{1,2} Therefore, Goldmann applanation tonometry may be adequate for measuring the IOP in eyes with a shallow angle to preserve the corneal endothelium. As our observation did not detect a substantial change in the corneal endothelial cell count, any changes in the endothelium resulting from mechanical stress may happen over the long term. We advise caution when examining eyes with angle closure because they might be particularly affected by external pressure, which in this new device may result in iridocornea touch that is harmful to the cornea, although we observed this effect in only 1 case, and there could be limitations in its interpretation.

REFERENCES

1. Hon Y, Lam AK. Corneal deformation measurement using Scheimpflug noncontact tonometry. *Optom Vis Sci.* 2013;90:e1–e8.
2. Hong J, Xu J, Wei A, et al. A new tonometer—the Corvis ST tonometer: clinical comparison with noncontact and Goldmann applanation tonometers. *Invest Ophthalmol Vis Sci.* 2013;54:659–665.