LETTERS TO THE EDITOR

In the recent article titled *The New Ocular Biometers: How Do They Stack Up?* (July/August 2015, pg 45; http://crstodayeurope.com/2015/07/the-new-ocular-biometers-how-do-they-stack-up/), the authors stated that, "The Galilei G6 (Ziemer), combining optical A-scan, dual-Scheimpflug imaging, and Placido-disc topography, is reported to measure most ocular elements; however, posterior cornea and corneal aphericities do not appear to be available." As a long-time user and design contributor of the Galilei, it seems to me that the authors did not have experience with this device, as posterior cornea analysis is available and visible in several ways.

Since the first Galilei G1, the Alternate Profile I created in 2008 had both the Axial Anterior-Posterior Topography Report and the Instantaneous Anterior-Posterior Topography Report showing posterior curvature maps in diopters with inverted color scales.[1] This view of the posterior cornea allowed a simpler comparison with anterior surface maps and faster interpretation of findings (Figure 1).[2] Furthermore, all Galilei versions (G1, G2, G4, and G6) have always had available posterior axial and posterior tangential curvature maps, posterior best fit sphere, best fit asphere, and best fit toric asphere elevation maps as well as automatically shown numerical data such as the posterior mean keratometry, flatter and steeper posterior curvature, or posterior cylinder and axis (Figures 1 and 2).

The Galilei G6 is the first optical biometer by interferometry available on the market that includes, without assumptions, a true calculation of the total corneal power by ray tracing and shows the axial length and IOL power calculation[3] with links with new ray-tracing IOL formulas, and thickness of the natural lens or an implanted IOL (Figure 3). Reliable total corneal power[4] and pachymetry[5] were possible because the posterior cornea is detected, assessed, and available in the Galilei.

Multiple studies on this aspect have been published[6,7] and presented at international meetings, showing the good repeatability and applications of Galilei posterior corneal surface data. The Charles D. Kelman Innovator's Lecture at the 2012 ASCRS meeting about corneal optics and toric IOL calculation[8] and the Troutman Prize of 2013 about keratoconus screening[9] are two of them.

On the other hand, corneal asphericity is represented numerically by the q factor being $q = -e^2$, where e^2 is squared eccentricity. All Galilei versions always calculated and showed these values from both the anterior and the posterior corneal surfaces from an 8-mm-diameter central zone aligned to the vertex (in the G1) or to the first Purkinje (SW 6.0 or newer). Finally, Galilei also determines the anterior, posterior, and total corneal spherical aberration, which is directly related to the q factor (or inverse with the e^2; Figures 1 and 2).

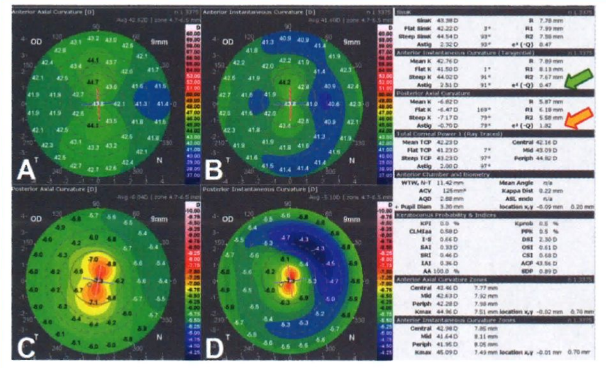

Figure 1. Axial (A and C) and instantaneous (B and D) curvature maps of a cornea with symmetric with-the-rule astigmatism in a normal (q = -0.47; green arrow) aspheric anterior surface (A and B) and symmetric with-the-rule astigmatism in an already steeper than normal (orange steps on maps) hyperprolate (q = -1.82; orange arrow) aspheric posterior surface (C and D).

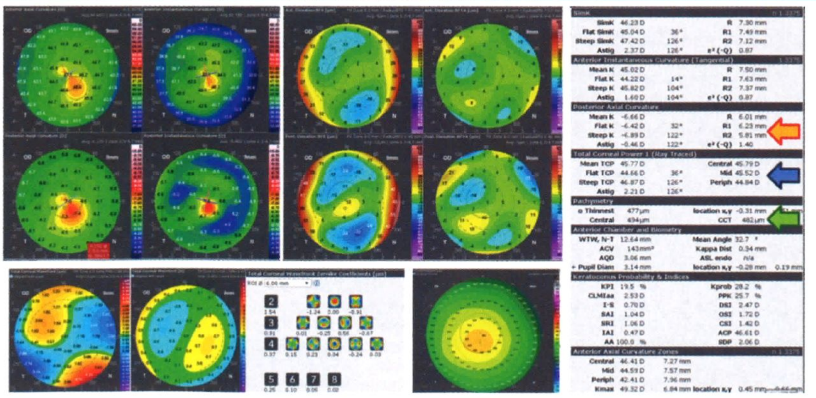

Figure 2. Axial and instantaneous curvature maps (top left), best fit sphere and best fit toric asphere elevation maps (top right), total corneal wavefront and coma maps (bottom left), Zernike pyramid (bottom center), and pachymetry map (bottom right) of the right eye of a young woman with initial keratoconus and a maximum keratometry of 49.32 D. The left cornea was similarly thin but normal. Posterior axial curvature and asphericity (orange arrow), total corneal power (blue arrow), and pachymetry (green arrow) are among the numerical indices.

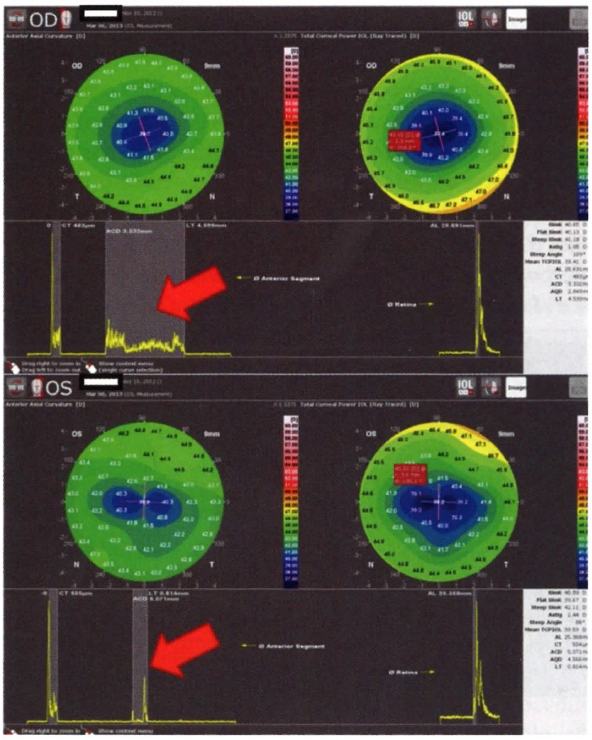

Figure 3. Axial curvature (top left), pachymetry (top right) corneal maps and optical A-scan of both eyes of a woman who underwent myopic LASIK, showing the thickness of her natural lens in the right eye and the position and thickness of the IOL implanted in the left eye.

Taken together, it is important that physicians understand the scientific and medical benefits of posterior analysis and imaging capabilities on the Galilei. These features offer users an opportunity to make informed treatment choices for patients and ensure that clinical care achieves a level of excellence.

Carlos G. Arce, MD
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Dear Dr. Arce,

Thank you for your letter highlighting the blatant error in our article. You are absolutely correct that the statement made by us regarding the Galilei G6 combining optical A-scan, dual-Scheimpflug imaging, and Placido-disc topography omitting to measure posterior cornea and corneal asphericities is simply incorrect.

We are unsure how this error occurred, as the entire team is aware of the capabilities of the Galilei and the work done by Douglas D. Koch, MD, and his team on the posterior corneal toricity and its impact on total corneal toricity using this device. Thank you for your feedback and setting the record straight for our readers. This error should never have occurred, and we collectively apologize for it.

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Michael Mrochen, PhD
Zürich, Switzerland

We have received some calls and emails from surgeons regarding an article published in the October issue, *Ones to Watch: Premium IOL Technologies*, written by Jorge L. Alió, MD, PhD (pg 33; http://crstodayeurope.com/2015/09/ones-to-watch-premium-iol-technologies/).

In the article, Reviol, which is actually a diffractive bifocal lens, was listed as a refractive IOL. As it is well known today, refractive IOLs are considered an old technology, and many models have been discontinued in the past due to neural adaptation problems and severe patient complaints. In this regard, we would like to remark again that Reviol is established on the principles of diffractive IOL technology, which is so-called *active* diffractive optics. The IOL is fully pupil independent, provides maximum light transmission, has unique light distribution structure, and gives a high rate of spectacle independence.

Further, Professor Alió did not mention the Tri-ED trifocal IOL in his discussion on trifocal lens technologies. The Tri-ED IOL combines trifocal diffractive technology and extended depth of focus vision, which is the first type of IOL on the market to provide continuous vision under all light conditions. ■

Fatih Ergin, PhD
Product Manager, VSY Biotechnology

CRST Europe *regrets this error and this omission.*

DIAGNOSIS OF THE MONTH

ZIEMER'S Z8 FEMTOSECOND CATARACT LASER IN CASE WITH PREVIOUS RADIAL KERATOTOMY AND TAMULOSIN

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Case Study

A 76-year-old patient on Tamulosin who underwent 8-incision radial keratotomy for his myopia 22 years ago presented with a cataract in his left eye. Femtosecond Laser Assisted Cataract Surgery (FLACS) was performed under topical anesthesia using the Z8 laser (Ziemer Ophthalmic Systems AG, Switzerland) in the operating room under the surgical microscope. The laser was set to make a capsulotomy of 5.1mm and nucleus fragmentation into 8 pieces. Despite the history of Tamulosin use, the preoperative pupil size was enough to program a 5.1mm capsulotomy. The suction ring of the Z8 was applied and a stable vacuum level was achieved before filling the suction cup with normal saline. The laser handpiece was subsequently docked onto the fluid-filled suction cup interface. The Z8 then did an OCT scan of the anterior segment and the capsulotomy was automatically centered in relation to the pupil and the fragmentation was automatically placed within the lens. The depth of fragmentation was adjusted to keep a 600um safety zone above the posterior capsule. Due to its "small bubble technology" the Z8 is able to perform the fragmentation first before proceeding with the capsulotomy after the surgeon confirms approval of the patient's pupil diameter.

Figure 1 shows the well-centered capsulotomy and fragmentation of the nucleus (the patient was not looking directly at the camera when the picture was taken). The already free capsulotomy was gently removed with a capsulorhexis forceps following inflation of the anterior chamber with a viscoelastic. A gentle hydrodisection was performed, after which the nucleus was gently decompressed. Phacoemulsification was done by holding the dense nucleus with high vacuum and completing separation of the 8 fragments with a chopper. There was no need for a central trench prior to fragment removal. The total phaco time was 35 seconds with a total phaco power of 5%. The desired IOL was safely implanted after a thorough irrigation and aspiration. The pupil size at the end of the procedure was slightly smaller than the preoperative pupil size due to intraoperative floppy iris syndrome attributable to Tamulosin. The two paracentesis wounds were sealed with stromal hydration and 2% fluorescein was used to confirm the absence of any leakage through the radial keratotomy wounds (Figure 2).

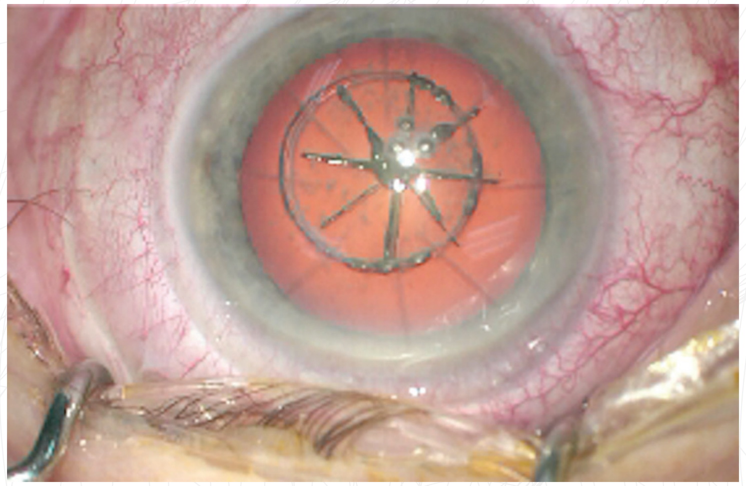

Figure 1. Appearance of the capsulotomy and fragmentation immediately after the laser procedure in eye with radial keratotomy.

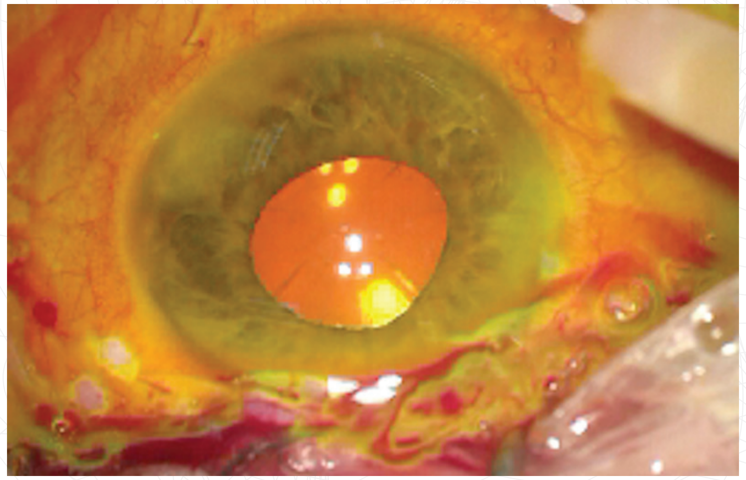

Figure 2. Application of 2% Fluorescein and compression of the sclera showing no evidence of leakage through the radial keratotomy incisions.

Discussion

FLACS is the most recent application of femtosecond laser technology in ophthalmic surgery and appears to be a safe, efficient, and reproducible procedure.[1] The benefits of FLACS have been presented elsewhere.[2,3,4,5] The Z8 laser utilizes a fluid-filled patient interface which provides a relaxed, non-deformed cornea without posterior corneal folds.[6] This avoids degradation of the laser beam's focus, assuring an optimal resection with complete capsulotomies. The liquid interface produces a minimal increase in intraocular pressure, which is especially important for elderly patients and patients with prior corneal surgery. It is known that precise femtosecond laser application is difficult to achieve in the presence of corneal scars. However, this case proves that in cases with faint scars, like in radial keratotomies, femtosecond laser application with the Z8 is not an issue.

An important benefit of the Z8 laser is its small size and mobility, which simplifies patient flow as there is no need to move the surgeon or the patient. The surgeon can still perform high volume lists without employing an additional doctor to operate the laser, or dedicating a separate room for the laser next to the main operating theatre. The preliminary outcome of our audit at the Sussex Eye Hospital showed an average difference of 158 seconds for the surgical time (from Betadine application on the skin to removal of the drape) between Z8-assisted vs. conventional phacoemulsification.

In summary, the Z8 laser performs safely and effectively in cases with minimal corneal opacities, such as after radial keratotomies, and the fluid-filled interface provides more safety to the potentially weaker radial keratotomy incisions which can risk gaping/leaking if direct applanation is applied.

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