POSTERIOR CORNEAL CHANGES IN SUPERIOR VS. TEMPORAL INCISIONS

The success of refractive lens surgery depends on accurate pre-operative keratometric readings and predictable post-phacoemulsification keratometric changes.

The majority of older cataract patients have against-the-rule (ATR) corneal astigmatism, with the steep meridian oriented along or close to 180°. With the advent and improvement of multifocal IOL technology offering one-in-all refractive solutions for presbyopia, myopia and astigmatism, refractive cataract or lens exchange patients are presenting progressively earlier. These younger patients often have with-the-rule (WTR), with the steep meridian oriented along or close to 90°.

Most refractive cataract surgeons are divided in opinion as to placement of phaco incisions, some adhering to a well entrenched dogma of operating on the steep meridian, which, in the case of younger patients, is often vertical, necessitating a superior incision.

The effect of incision placement on anterior K readings is well documented, with superior 3.5 mm incisions correcting as much as 1.5D of WTR astigmatism.[1] More recent data indicates superior 2.8 mm incisions correct as much as 0.75D of WTR astigmatism whilst temporal and nasal incisions remain relatively astigmatically neutral.[2]

Total corneal astigmatism is the sum of both the anterior and posterior astigmatism, and is of value as it influences post operative refraction.

In this article, we would also like to illustrate some of the possible changes the posterior cornea undergoes with different incision locations that should be taken into account when planning refractive cataract surgery.

Case 1

A 52-year-old lady with myopia and early cataracts presented for left refractive lens exchange. Keratometry was determined with the Galilei G4 combined Placido/Dual Scheimpflug Analyser (Ziemer AG, Port, Switzerland) which was then fed into the Lenstar LS900 optical biometer (Haag-Streit, U.S.A).

Keratometry revealed anterior WTR astigmatism of 0.54D and negligible ATR posterior corneal astigmatism. (Figure 1) During surgery, a 2.75 mm on-axis superior corneal incision was made, and a diffractive trifocal IOL implanted. On the first post-operative day, her uncorrected distance visual acuity (UCDVA) was 0.3 logMAR which did not improve at 1 week. Manifest refraction was plano/-1.50 x 090.

A repeat Galilei scan revealed flipping of the anterior keratometric axis, with significant increase of the anterior corneal astigmatism (0.54D pre-op to 1.17D post-op). Crucially, there was steepening of the posterior corneal surface with increase in ATR posterior corneal astigmatism (0.25D to 0.91D). The steepening was localized and involved the central 3 mm zone. (Figure 2)

Case 2

A 49-year-old lady with myopia and early cataracts presented for right refractive lens exchange. IOL power was calculated combining keratometry from the Galilei G4 and axial length from the Lenstar.

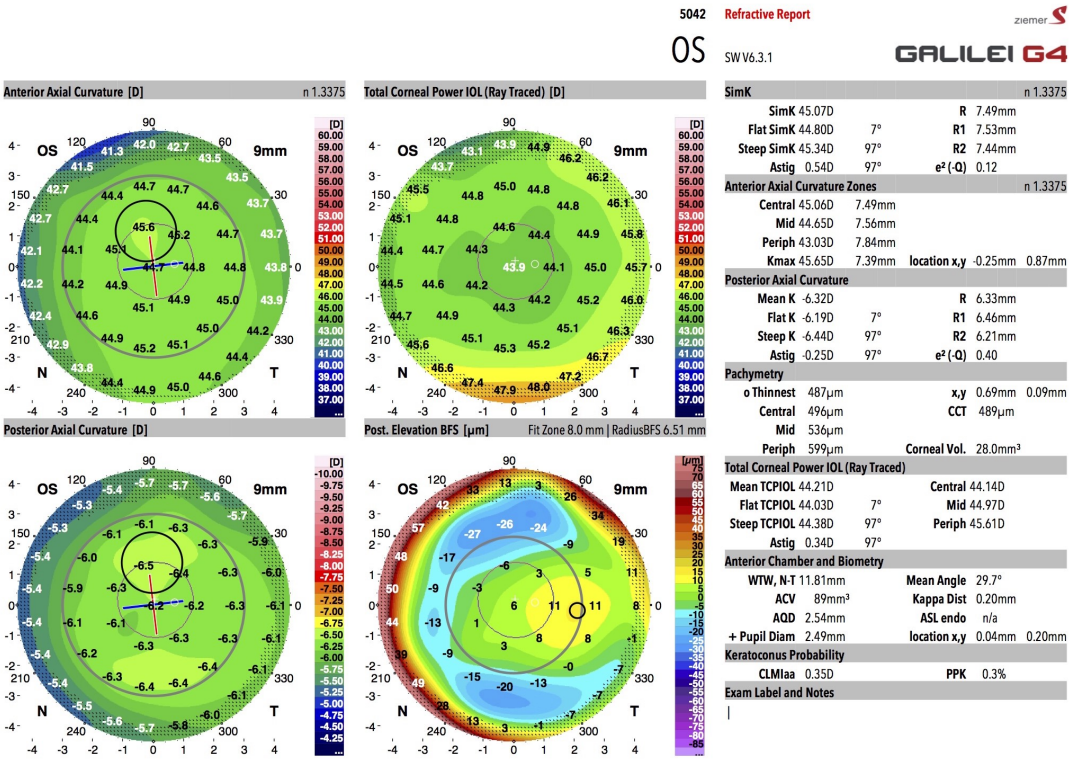

Figure 1: Mild WTR anterior and negligible ATR posterior astigmatism

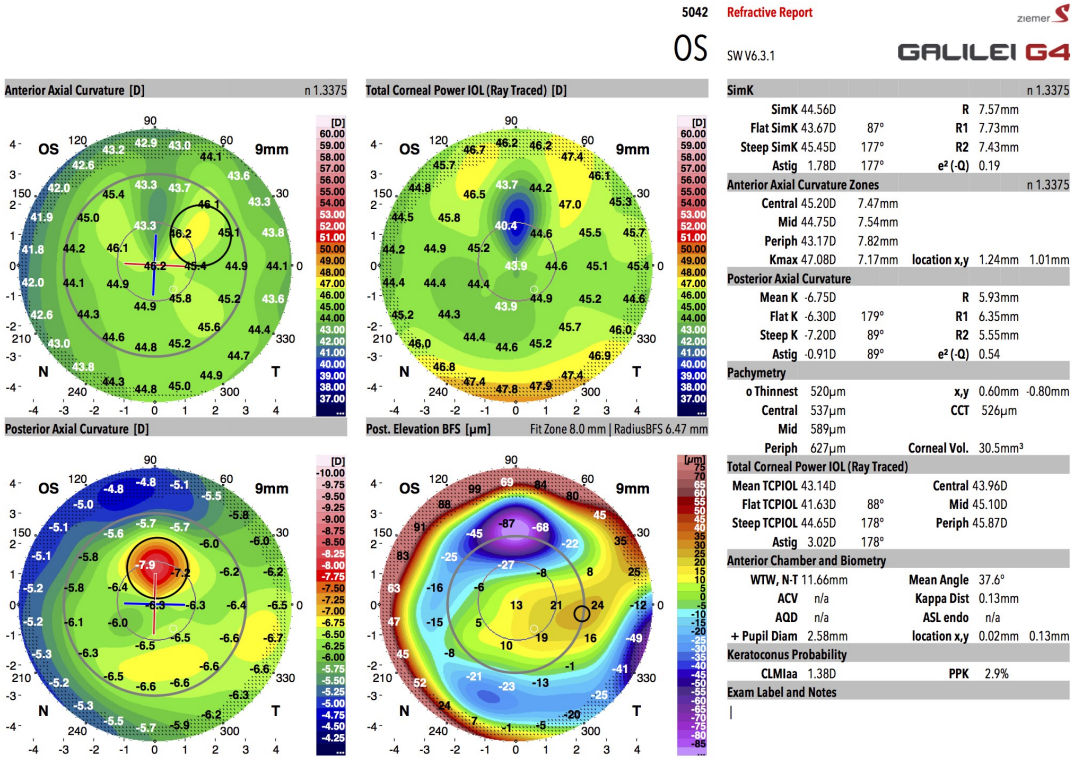

Figure 2: Moderate ATR anterior astigmatism, increased ATR posterior astigmatism with localized steepening encroaching central cornea

Keratometry revealed severe anterior WTR astigmatism of 2.61D and mild posterior ATR astigmatism of 0.56D. (Figure 3) A temporal 2.75 mm incision was made, and a toric progressive multifocal IOL was placed. Post operative day 1, her UCDVA was 0.0 logMAR, with uncorrected near visual acuity (UCNVA) J2 at 40cm. Manifest refraction was -0.25/-0.50 x 175.

Repeat Galilei scan revealed minimal anterior keratometric change (2.61D pre-op to 2.36D post-op, with no axis flipping), and crucially, negligible posterior keratometric change (0.56D pre-op to 0.58D post-op). (Figure 4)

Case 3

A 69-year-old lady with myopia and significant cataracts presented for right cataract surgery.

IOL power was calculated combining keratometry from the Galilei G4 and axial length from the Lenstar.

Keratometry revealed mild anterior WTR corneal astigmatism of 0.62D and mild posterior corneal ATR astigmatism of 0.47D. (Figure 5) A temporal 2.75 mm incision was made and an aspheric monofocal IOL was placed. Surgery was uncomplicated, and on the first- operative day, her UCDVA was 0.1 logMAR, with no subjective improvement at 1 week.

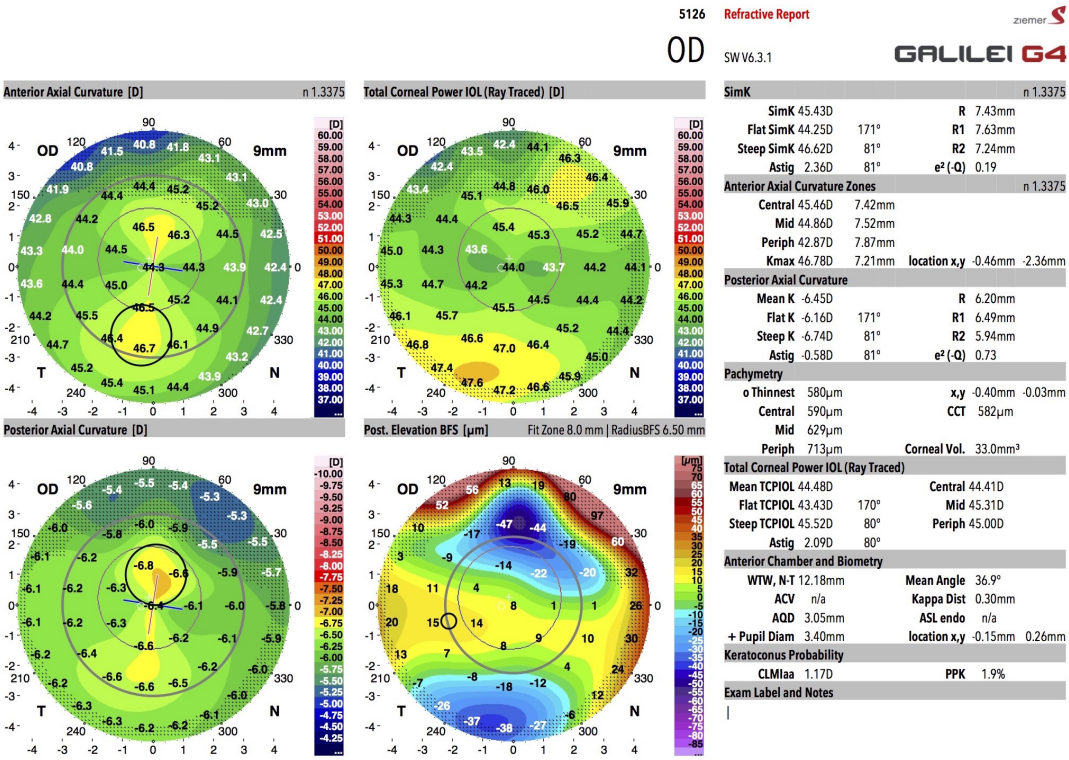

Figure 3: Severe WTR anterior and mild ATR posterior astigmatism

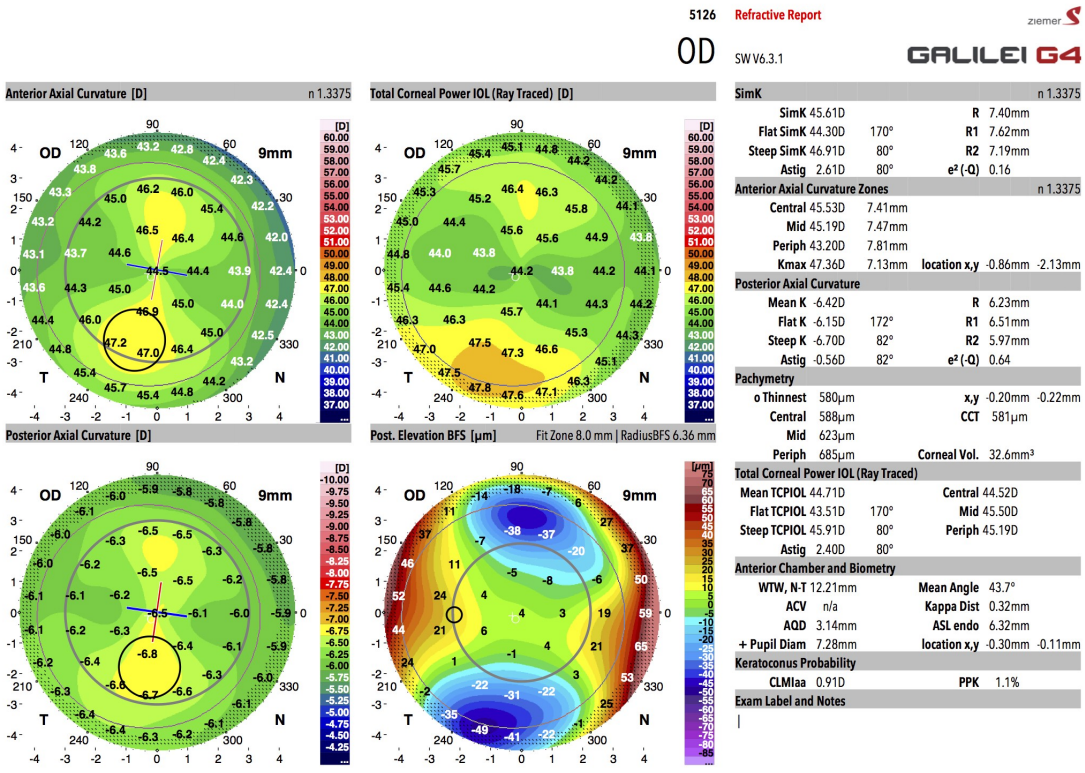

Figure 4: Negligible change in both anterior and posterior astigmatism

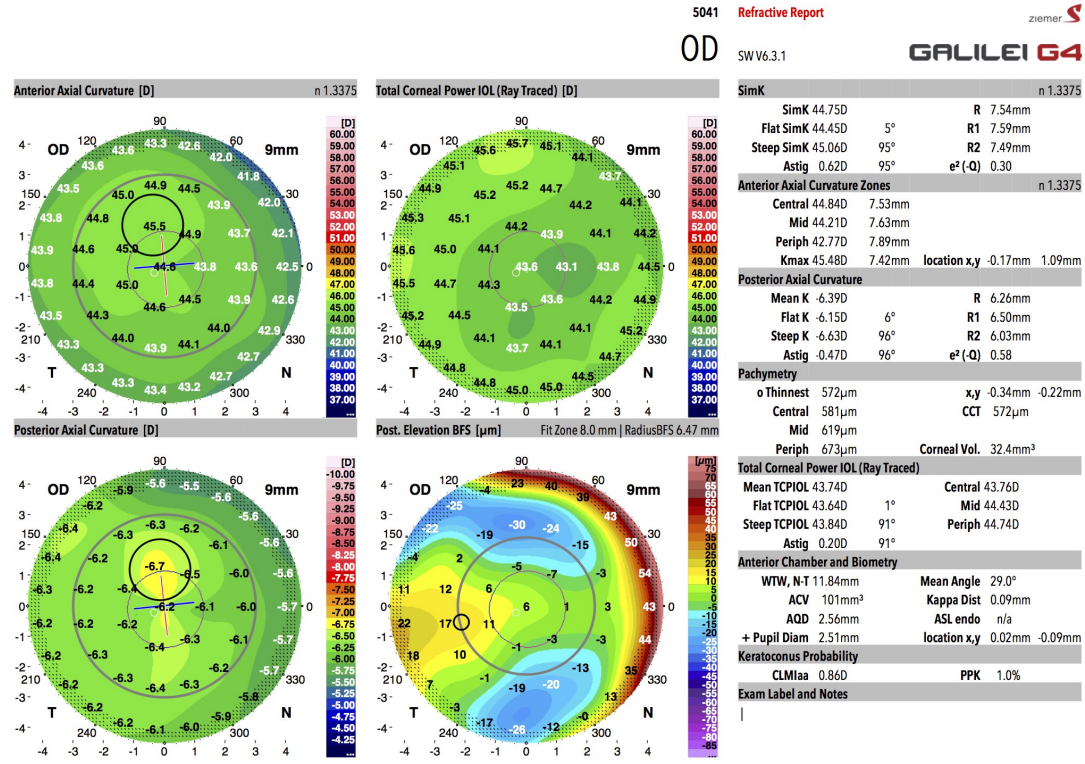

Figure 5: Mild WTR anterior and mild ATR posterior astigmatism

Galilei scan at 1 week was instructive. Though there was localized steepening of the posterior cornea at the incision site, it did not encroach the central 3 mm zone.

Keratometry remained relatively intact, with minimal anterior corneal changes (0.62 to 0.84D WTR) and mild posterior corneal changes (0.47D pre-op to 0.20D post-op). (Figure 6)

Discussion

The relatively neutral temporal incision is well documented. However, in the mentioned cases, we have demonstrated that unwanted steepening of the posterior cornea may occur regardless of incision location.

The above cases are instructive. Apart from suggested effects of gravity and the eyelid on superior incisions, the shorter vertical dimensions of the cornea, deep set eyes and prominent eyebrows often cause superior incisions to be placed anteriorly, with the inner wound edge encroaching into the central zone. This may necessitate steep angulation of the phaco probe, especially in myopic patients, with resulting localized distortion of the inner wound lip.

Temporal incisions tend to be more peripherally placed, in part due to ease of access and longer horizontal diameter. In addition, because the steepening effect is localized, peripheral incisions tend to have smaller effects on the central cornea.

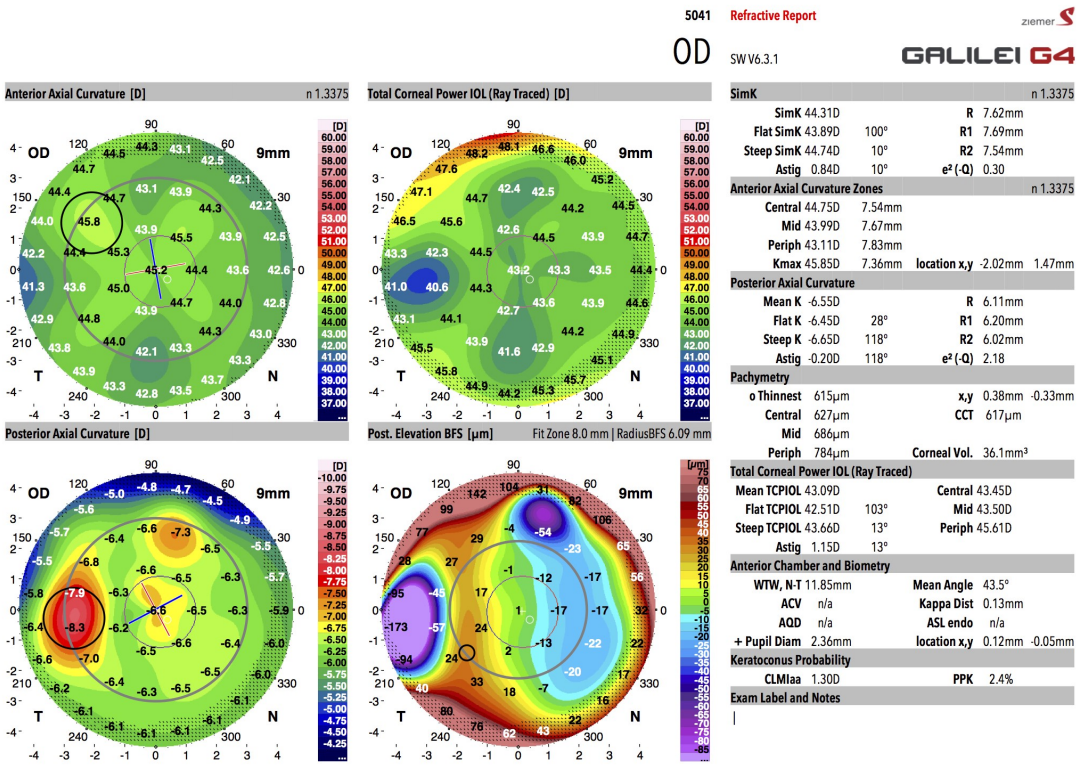

Figure 6: Negligible change in both anterior and posterior astigmatism with localized steepening peripheral, no encroachment of central cornea

Conclusion

Refractive lens or cataract surgery depends on predictable keratometric changes. When planning the incision location, possible posterior corneal changes should be taken into consideration. Out of necessity, superior incisions may often be placed more anteriorly, increasing the risk of unwanted central posterior corneal changes influencing the central cornea.

References

1. Jaime Tejedor, Juan Murube. *Choosing the Location of Corneal Incision Based on Preexisting Astigmatism in Phacoemulsification*. American Journal of Ophthalmology. May 2005. Volume 139, Issue 5, Pages 767–776

2. Jaime Tejedor; José A. Pérez-Rodríguez. *Astigmatic Change Induced by 2.8-mm Corneal Incisions for Cataract Surgery*. Investigative Ophthalmology & Visual Science March 2009, Vol.50, 989-994. doi:10.1167/iovs.08-2778

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