IOL Calculation in Patients with Fuchs' Endothelial Dystrophy

Carolin Kolb-Wetterau and Mehdi Shajari

In eyes with Fuchs' endothelial dystrophy (FED), phacoemulsification with lens implantation can be performed before or after an endothelial keratoplasty or as a combined technique in an approach known as a triple-DMEK. The ratio of anterior to posterior corneal surface in these patients is typically very different to healthy eyes. Hence, ideally, the preoperative measurements for the IOL power calculation should include the posterior surface. It should be noted that calculations with TCRP instead of SimK values result in a myopic shift.

In FED, corneal edema leads to flattening of the back surface, resulting in a myopic shift. In addition, the refractive indices change due to the disordered arrangement of the corneal collagen fibrils. As a result, the accurate measurement of eyes is more difficult. In order to minimise error, it is reasonable to perform the measurements as late as possible during the course of the day and to apply hyperosmolar eye drops previously. Triple-DMEK is not recommended in the case of a pronounced cornea guttata, as central guttae lead to unreliable values.

An exact prediction of refractive changes by endothelial keratoplasty is not currently possible. The refractive power of the anterior corneal surface only decreases slightly, whereas the absolute value of the refractive power of the posterior surface increases and thus the TCRP decreases. Due to the corneal detumescence after endothelial keratoplasty there is usually a hyperopic shift. This is even more pronounced the thicker, i.e. more oedematous and decompensated, the cornea is prior to corneal transplantation, the greater is the ratio of the radius of the back to the front surface, and the higher is the posterior asphericity quotient (Q value), i.e. the flatter is the back surface. The sole consideration of corneal thickness or posterior corneal radius is not suitable for assessing the risk of a hyperopic shift [1].

C. Kolb-Wetterau (✉) · M. Shajari
Goethe University Frankfurt, Frankfurt, Germany
e-mail: carolin.kolb-wetterau@outlook.de

M. Shajari et al. (eds.), *Cataract and Lens Surgery*,
https://doi.org/10.1007/978-3-031-05394-8_33

In comparison to the Hoffer Q, Holladay I, and Haigis, calculations with the SRK/T and the use of K-values of the IOLMaster, i.e. without considering the posterior corneal surface, show the smallest deviations from ray-tracing based calculations (of the OKULIX software) which includes the corneal front and back surface [2]. However, there are currently no recommendations as to which formula leads to the best results.

Toric lenses can be implanted in selected cases of severe astigmatism. The unpredictable change in astigmatism caused by endothelial keratoplasty, especially in its orientation, should be taken into account [3].

Due to the rather poor predictability of the refractive outcome in patients with FED, the surgeon must choose individually whether first the lens should be exchanged, a DMEK or DSAEK should be done, or a triple-DMEK procedure would be the best choice. For example, in a patient with advanced corneal decompensation but only a mild cataract it is a reasonable approach to first perform DMEK and, after the corneal situation is stable, exchange the lens, as in a mild cataract the required ultrasound energy to remove the lens will be minimal and probably will not reduce the endothelial cell density significantly. On the other hand, if a patient has a very dense cataract but only mild corneal decompensation it is a better approach to first remove the lens and afterwards perform an endothelial keratoplasty to prevent corneal damage. A triple procedure is probably the best choice when the cataract and corneal decompensation is advanced and the patient is rather old or has a generally bad health condition and the number of surgeries should be reduced to the lowest number possible.

Author's recommendation

The following recommendations are suitable for reducing hyperopic errors during cataract surgery after or combined with DMEK:

- Due to the hyperopic shift after endothelial keratoplasty, a myopic outcome of -0.5 to -1.0 dpt should be targeted. The higher the preoperative posterior Q-value, the higher the risk of a hyperopic shift and the more myopic the target refraction should be chosen. It should be set slightly less if hyperosmolar eye drops were applied before the measurement.
- If surgery is indicated on both eyes, the calculation of the second eye can be based on the refractive results of the contralateral eye.
- Due to the overall poor predictability it is recommended to decide individually whether the DMEK or the lens exchange should be performed first or a triple-DMEK is the best choice.

References

1. Fritz M, Grewing V, Böhringer D, Lapp T, Maier P, Reinhard T, u. a. Avoiding hyperopic surprises after descemet membrane endothelial keratoplasty in Fuchs dystrophy eyes by assessing corneal shape. Am J Ophthalmol. 2019;197:1–6.
2. Alnawaiseh M, Zumhagen L, Rosentreter A, Eter N. Intraocular lens power calculation using standard formulas and ray tracing after DMEK in patients with Fuchs endothelial dystrophy. BMC Ophthalmol. 23. August 2017;17(1):152.
3. Shajari M, Kolb CM, Mayer WJ, Agha B, Steinwender G, Dirisamer M, u. a. Characteristics of preoperative and postoperative astigmatism in patients having Descemet membrane endothelial keratoplasty. J Cataract Refract Surg. Juli 2019;45(7):1001–6.