IOL CALCULATION

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by Roibeard O'hEineachain in Milan

IOL calculation in LASIK or PRK-treated patients must be based on the cornea’s current dimensions and must be free of assumptions based on a standard model of the eye. Wolfgang Haigis MS, PhD, University Eye Hospital, Wuerzburg, Germany told the XXX Congress of the ESCRs.

In cataract patients who have undergone previous corneal refractive surgery there are several possible types of error in IOL calculation that can lead to refractive surprises. Chief among them are those resulting from the use of inappropriate keratometry calibrations (keratometer index) and those that result from the false assumptions that some IOL power formulas make regarding the internal dimensions of such eyes, noted Dr Haigis.

Keratometry instruments measure the height of a reflected image on a presumed convex spherical surface and derive from it the anterior cornea’s radius of curvature. However, following LASIK or PRK there are differences in curvature between that of the untreated peripheral cornea and that of the central optical zone. The result is that in eyes that have small optical zones after refractive surgery the standard keratometry instrumentation may give the radius for the untreated cornea, Dr Haigis said.

“If you measure a steeper radius, as would be the case in a patient who had undergone myopic LASIK, it is then equivalent to a stronger corneal power, which finally translates into a weaker IOL power, which translates into a weaker IOL power, which finally translates into a hyperopic error,” Dr Haigis said.

Another type of error is the keratometry index error. That results from the derivation of the total corneal power from the anterior radius alone, based on the assumption that the cornea’s posterior radius will have the same correspondence to the anterior radius as it did before refractive surgery.

A third type of error is the IOL formula error, wherein the flattening of the cornea causes the formula to yield erroneous values for the effective lens positions. In eyes treated for myopia the formula will assume a more anterior lens position than would actually be the case. With some formulas, that in itself can result in hyperopic refractive shifts of around +2.0 D.

IOL calculation methods that use the patient’s treatment history are impractical because in most cases the data is not available. Methods using only current data include the R-factor method, the Shammas no-history method, the BESSt formula, which uses Pentacam (Oculus) measurements, and the Haigis-L formula, which uses measurements obtained with the IOLMaster (Carl Zeiss Meditec).

Dr Haigis presented the results obtained with the Haigis-L formula in 226 eyes that had undergone LASIK for myopia and 57 eyes that had undergone hyperopic LASIK. The study involved 82 surgeons who implanted 50 different types of IOL.

At final refraction the median absolute prediction error was 0.37 D for the myopic eyes and 0.4 D for the hyperopic eyes. Furthermore, in both the hyperopic and myopic LASIK groups around 82 per cent of eyes were within one dioptre and around 60 per cent were within half-a-dioptre of predicted refraction Dr Haigis said.

He added that the refractive results achieved with the Haigis-L formula in patients with previous surgery are close to the current standard benchmark for normal eyes, which is 85 per cent of eyes within 1.00 D and 55 per cent within 0.50 D of the predicted values.

Dr Haigis added that the IOLMaster comes with the Haigis-L formula already implemented in its software from version 4.x onward. The Haigis-L formula is also available at: www.ascrs.org.

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