27 July 2023

Explanatory document to accompany modified cataract refractive dataset

Cataract refractive minimum dataset

In cataract surgery, IOL selection is largely governed by the surgeon assessing the biometric output and choosing an IOL to meet desired target refractive outcome. This is currently presented to the surgeon as a single (scalar) value, i.e., a spherical equivalent (SE), as the biometric formulae use an average of the two measured keratometry values, namely K1 and K2, as the expected effective lens position will be slightly different for K1 and K2.

For a non-toric IOL, the expected outcome associated with the selected IOL is therefore presented as a spherical outcome, that is, a SE based on the difference between K2 and K1. The expected outcome is also based on the assumption that the keratometry and all the other ocular parameters do not change following surgery. The surgeon may of course intentionally modify their surgery to change some of the ocular parameters.

Presenting the surgeon with a spherical equivalent outcome, however, only provides the surgeon with limited information on the expected outcome and induces the surgeon into expecting that the outcome will be spherical. For the surgeon to interpret the spherical equivalent and to consider whether they wish to modify their surgery, they also need to be presented with the expected outcome in S/Cxa or other form.

The first step in this process, therefore, is to enable the surgeon to see the outcome as a spherocylinder, so that they have the information to decide if they regard the expected outcome as acceptable and or if they wish to modify their surgery to try and achieve a different or other desired outcome.

This is very easily achievable. If the difference between K2 and K1 reflects the cylinder, then using the current formula for the SE, that is $SE \cong S + \frac{C}{2}$, where the SE is known from the biometry, we have:

$$S \cong SE - \frac{C}{2}.$$

Therefore, the outcome can be written as a spherocylinder, S/Cxa where C ≅ K2-K1, and a is the meridian of K2.

For example, if K1: 42.17 and K2: 43.23 @ 17

and if an IOL of +20.5 is selected to give a SE outcome of -0.24, then,

$$\frac{C}{2} \cong = \frac{K_2 - K_1}{2} = \frac{43.23 - 42.17}{2} = +0.53$$

So, C = +1.06

Therefore,

$$S \cong SE - \frac{C}{2} = -0.24 - 0.53 = -0.77$$

Then in this example, if none of the ocular parameters change, the expected outcome in S/Cxa form would be,

-0.77/+1.06 x 17.

It is not expected that the surgeon does this calculation as mistakes are easily made. The software for this calculation will be in the EMR and the result presented to the surgeon.

For example, the biometry in this example would be presented as follows according to the surgeon's preference:

IOL	**Expected outcome**			
	SE	S/Cxa (+cylinder)	S/Cxa (-ve cylinder)	Cross cylinder
20	-0.24	-0.77/+1.06x17	+0.29/-1.06x107	-0.77x17/+0.29 x 107
20.5	-0.59	-1.12/+1.06x17	-0.06/-1.06x107	
21	-0.94	-1.47/+1.06x17	-0.41/-1.06x107	

Once the expected outcome is presented as a spherocylinder, the surgeon may wish to modify their surgery e.g., operate at the steep meridian, suture the wound, use a LRI or select a toric IOL etc. The effect of these surgical modifications on the expected outcome then also needs to be calculated and presented to the surgeon as part of the EMR.

For example, if the surgeons knows that their incision results in a keratometric change of -0.29D in the meridian of their incision and a steeping of +0.19D in the meridian at 90 degrees away from their incision, then this keratometric effect could be added to the pre-operative measured keratometry to predict the post-operative keratometry and the resultant refractive outcome. There are very well-established methods for these calculations which can easily be made available in an EPR.

Once the expected and or desired refractive outcome is known in S/Cxa form, then the difference from the actual post-operative outcome can be measured. It has been well documented that interpreting and evaluating the outcome in spherocylinder form is much more sensitive in guiding the surgeon and also for detecting outliers than relying on the outcome as spherical equivalent.[3,4] Importantly, using this approach it has been shown that surgeon effects on the unexplained variance in refractive outcome are very small compared to patient and biometric factors.[5] That is, there is very little variation in refractive outcomes between surgeons using similar techniques.

The Royal College of Ophthalmologists cataract and minimum reporting data sets (https://www.rcophth.ac.uk/standards-and-guidance/audit-and-data/clinical-data-sets/) have now been modified and it is expected that the EMR providers will facilitate these changes.

References

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3. Aristodemou P. et al., Evaluating refractive outcomes after cataract surgery. *Ophthalmology* 2019;126(1):13-18 https://pubmed.ncbi.nlm.nih.gov/30153943/
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