Subjective Refraction in Eyes With Multifocal IOLs

To the Editor:

Piñero et al,1 in the August 2010 issue of the Journal of Refractive Surgery, addressed the complexity of obtaining refraction in eyes that have been implanted with multifocal intraocular lenses (IOLs). It has been shown that automated and wavefront refractors may not yield accurate measurement of residual refractive error for secondary laser vision correction in eyes with multifocal IOLs.2,3 and manifest refractions are likely to be affected by the multifocality of these lenses.3 Piñero et al1 suggested an averaging approach to the midpoint where the patient maintains 20/20 vision. This subjective clue should at least partly avoid the variability in the spherical component of the refraction.

We describe our approach in refracting such eyes especially when a keratorefractive enhancement is planned.

1. Create a high mesopic (9 lux) or photopic condition.

2. Correct the keratometric cylinder error (at the spectacle plane) if needed (it is assumed that the multifocal IOL is not tilted); add the corresponding sphere (1/2 cylinder of opposite sign). For partial monovision, we aim for mild distance dominance in the right eye and mild near dominance in the left eye (this should be modified based on the patient’s lifestyle, occupational demand, and ocular dominance).

3. Right eye: we move the distance point farther with a minus lens (beyond IOL calculation error; approximately −2.00 diopters [D]). Then, we decrease the minus to achieve 20/20 distance vision. If simultaneous J2 (or even J3) or better near acuity is present, this is the endpoint.

4. Left eye: we move the distance point close with a positive lens (approximately +2.00 D). Then, we decrease the positive. As soon as J1 acuity at 40 cm is achieved, we check the distance vision; if an acuity of 20/25 or better is reached, this is the endpoint.

5. Binocular vision is measured next. The patient is expected to see 20/20 and J1 simultaneously.

This highly subjective and customized approach is a necessity. Conventional refraction in eyes with multifocal IOLs is unstable and highly dependent on the ambient light; therefore, any discussion about visual acuity without noting the luminance level is of little value.4 Step 3 of our method is similar to what has been suggested previously, ie, pushing toward the most hyperopic refraction possible that refracts the distance portion of the lens.3 However, this does not ensure fulfillment of far and near visual demands and does not address ocular dominance.

Correcting these eyes through wavefront-guided ablation is controversial.5 The laser would try to rectify higher order aberrations as well as the spherocylindrical residual error.2 Multifocality and higher order aberrations are two facets of the same phenomenon and create depth of field. Therefore, an aberrometry-guided correction may attenuate this desired symmetrical aberration induced by a multifocal IOL.

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Reply:

We thank Mohammadi and colleagues for their interest in our work. We evaluated the predictability and safety of LASIK to correct residual myopic and hyperopic refractive errors following cataract surgery using multifocal and monofocal intraocular lenses (IOLs). We found that LASIK refinement after cataract surgery with multifocal IOL implantation provided a more accurate refractive outcome than after multifocal IOL implantation. Specifically, we found a limited predictability of LASIK correction in hyperopic eyes implanted with multifocal IOLs. We suggested that this fact could be due to artifacts in the subjective refraction in hyperopic eyes implanted with multifocal IOLs. As a consequence of the presence of several foci (increased depth of field) with this type of IOL, several refractive options could lead to similar visual quality during the refraction procedure. The limitation of conventional refractive procedures in eyes with different types of multifocal IOLs has been documented.1,3 Muñoz et al2 demonstrated that spherical values after implantation of a refractive multifocal IOL were underestimated by automated refraction, which is normally used as a starting point for subjective refraction.
We proposed an approach to avoid the potential bias induced by IOL multifocality. It used the midpoint of the clear vision interval provided by the depth of field of the IOL (range of spherical lenses providing subjectively the same visual quality and the maximal visual acuity). We agree that this subjective “clue” only partially avoids the variability in the determination of the spherical component of refraction in patients implanted with multifocal IOLs. Mohammadi et al suggest a new approach that seems interesting; however, we do not know the exact physical or clinical basis for such an approach. Their approach considers binocular interaction. This could be useful in cases of bilateral implantation, but the problem remains in monocular cases. In any case, we agree that new protocols of refraction should be developed and used in patients implanted with multifocal IOLs. Studies are needed to provide clinical and scientific evidence of the validity of a specific refraction approach in such cases. Until a consensus is reached on the most appropriate procedure for refraction in eyes implanted with multifocal IOLs, a constant reference point or criterion for refraction is crucial to avoid postoperative problems of predictability when LASIK retreatments are planned after cataract surgery.

Furthermore, as Mohammadi et al stated, caution should be taken with wavefront-guided ablations because there is evidence of the limitation of global wavefront aberration measurements in eyes with multifocal IOLs. It has been demonstrated that Hartmann-Shack aberrometers are unable to detect the highest order aberrations induced by the diffractive components of a multifocal diffractive-based IOL. New specific devices should be developed for the clinical characterization of the ocular aberrometric profile in patients with multifocal IOLs, with the ability of allowing accurate calculations of a customized wavefront-guided ablation profile. In any case, these treatments will not compensate the eye for the ocular scattering induced by a diffractive element. Therefore, photic phenomena with multifocal IOLs may not be addressed by compensating the ocular higher order aberrations. This is something that should be taken into account.

We agree with Mohammadi et al that new protocols for subjective refraction should be developed and tested for eyes implanted with multifocal IOLs. Future studies comparing the reliability and consistency of the different approaches for subjective refraction in such eyes should be performed to provide scientific evidence for the best way to proceed.

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