

Intraocular Lens Power Calculations for Multifocal Intraocular Lenses

EDITOR:

In old-fashioned physiologic optics, the visual axis was defined as the imaginary line that connected the object of regard with the macula. This line intersected the cornea slightly inferonasally in the average eye and did not shift, no matter what the direction of gaze or what the distance. In the article, "Intraocular lens power calculations for multifocal intraocular lenses," by J. T. Holladay and K. J. Hoffer (Am. J. Ophthalmol. 114:405, October 1992), the authors imply that the patient uses the distant part of the lens for distant fixation and the add for near fixation. There are three ways in which this might be possible: the intraocular lens might change position; the visual axis might shift; or the visual axis might intersect the intraocular lens midway between the distance part of the lens and the reading add. Since the latter is most likely, why not insert a lens of power midway between distance and

near corrections and eliminate the more expensive multifocal lens altogether?

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Reply

EDITOR:

Although we did not mention the visual axis in our article, Dr. Snyder has raised some important questions. The visual axis is defined as the imaginary line that connects the object of regard and the macula, through the nodal point of the eye. The nodal point is near the posterior vertex of the crystalline lens in a phakic eye and near the posterior vertex of the intraocular lens in a pseudophakic eye. The visual axis of the pseudophakic eye does not change when moving from distance to near fixation, as Dr. Snyder erroneously thought we had implied in our article.

The visual axis of a multifocal intraocular lens does not need to change, because the lens uses the principle of simultaneous vision to produce the near and distance focus. Simultaneous vision provides two or more focal points along one visual axis. All multifocal intraocular lenses use the simultaneous vision principle whether they are diffractive, refractive, or a combination of the two. In contrast, alternating vision does require movement of the eye to produce two focal points, such as a traditional pair of flat top bifocals.

The question of choosing a single power for a monofocal lens, midway between the two

focal points of a multifocal intraocular lens, is what many clinicians have done for years when targeting for a postoperative refraction of -1.00 diopter. A patient with a monofocal intraocular lens with 1 diopter of myopia, no astigmatism, and no other ocular abnormality will see 20/20 at 1 m and approximately 20/40 at distance and near through a 3-mm pupil. In many patients this quality of vision is sufficient to be spectacle-free much of the time. As we mentioned in the article, monovision and compound myopia are two other methods by which monofocal intraocular lenses can reduce the dependence on spectacles.

A patient with a multifocal lens can have visual acuity of 20/20 at distance and 20/20 at near, which the monofocal lens cannot duplicate. However, the retinal image with the multifocal lens is from 30% to 50% lower in contrast than the monofocal image. Also, the multifocal lens will have some unwanted visual images such as rings, halos and veiling glare, which may be noticeable and cause symptoms in some patients.

Although the purpose of our article was to explain the appropriate method for calculating the distance power and near add for a multifocal intraocular lens, we believe it is important to clarify the important points raised by Dr. Snyder.

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