from the editor

Reporting astigmatism data

Does it seem easier to correct astigmatism than to analyze astigmatism data? This is certainly a conclusion that one could reach after reading this month's letters to the editor and reviewing recent literature on this topic.

We are grateful to Drs. Goggin and Pesudovs and Dr. Naeser for the thoughtful comments in their letters (pages 1548 to 1553). It is essential that refractive surgical articles use standardized, meaningful, and understandable criteria for reporting astigmatic results.[1] Although it appears that we are approaching this goal, their letters and the response of Holladay and Koch highlight the controversies that still exist. I would like to try to reframe the discussion.

To understand the astigmatic outcome of a procedure, we need 2 basic types of information: (1) the outcome from the patient's perspective and (2) the change produced by the procedure. The former describes the end result, whereas the latter indicates how that result was achieved.

To understand the results from the patient's perspective, the following elements are essential:

- Uncorrected visual acuity
- Mean, standard deviation, and range of actual postoperative astigmatism (refractive or corneal)
- Arithmetic change in astigmatism (refractive or corneal)
- Some measure(s) of surgically induced irregular astigmatism, including change in best spectacle-corrected visual acuity or contrast sensitivity. (Analysis of irregular astigmatism is another critical area in need of much further work.)

Obviously, 2 of these parameters contain no astigmatic data per se; rather, they reflect in part the effect of astigmatism on the patient's vision.

To understand how a procedure alters astigmatism, the analysis is more complex, and here the major differences in opinions arise. As a bare minimum, I suggest that the following are required:

- Vector analysis of the magnitude (in diopters) of surgically induced change (mean, standard deviation, and range).[2] Naeser dismisses this as "obsolete," but it is a crucial reporting element. Vector analysis indicates the magnitude of surgically induced change, which we must know if we are to understand the effect of the procedure. Certainly, vector analysis should not be the sole means of reporting astigmatic results.
- Analysis of aggregate data.[3,4] This polar coordinate value represents the trend for the population as a whole and indicates the mean magnitude and angular direction of the surgically induced change. Typically, in calculating this value for a series of patients, vectors in different directions partially cancel out one another; hence, the magnitude of this value is usually much smaller than the mean magnitude of the individual vectors for surgically induced change.

What else should be considered? Naeser recommends bivariate analysis with confidence intervals. As Goggin and Pesudovs state, additional parameters may be required if the surgical goal is to reduce pre-existing astigmatism; options include polar values[5] and the parameters described by Alpins.[6–8] Another crucial area is topographic analysis of astigmatic change, which, like the analysis of irregular astigmatism, requires much additional work.

Where do we go from here? In a future issue, we would like to facilitate a broader discussion of various analytical approaches. We will supply a refractive surgical data set to several experts and ask them to analyze the astigmatic results and explain their rationale. Their responses will be published, permitting us to compare methods, solicit input from our readers, and work toward a consensus. Ultimately, our goal is to identify methodology—and available software—that permits all of us to analyze our astigmatic data simply, uniformly, and meaningfully.

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