from the editor

Excimer laser technology: New options coming to fruition

In this issue of the journal, we see remarkable evidence of the growing sophistication and diversity of excimer laser technology. In four articles that describe results of astigmatic treatments, three types of lasers are used: (1) wide-field, (2) scanning, and (3) flying spot; and four mechanisms are used to produce astigmatic corrections: (1) expanding slits, (2) rotating mask, (3) erodible mask, and (4) flying spot. In studying these papers, what can we learn and what remains to be answered?

1. Each approach has demonstrated good efficacy or shows great promise as a treatment of astigmatism.

- In their report of an incredible 980 eyes treated with the VISX Twenty-Twenty laser, Higa et al. report a close correlation between the mean targeted and achieved astigmatic corrections in myopes up to 10.0 diopters (D); there was a trend for overcorrection of astigmatism in patients with myopia greater than 10.0 D.
- In a series of 29 primary treatments using the Aesculap Meditec MEL 60 with the scanning slit mode and rotating mask, Schipper and coauthors report a reduction in refractive cylinder from 2.57 D ± 1.37 (SD) to 1.10 ± 0.80 D.
- Danjoux and coauthors describe similar results using the Summit Apex Plus laser with an erodible mask; in 48 eyes, refractive astigmatism was reduced from 2.02 ± 1.00 D to 0.84 ± 0.84 D. Unlike the Higa report, these authors found a tendency for greater undercorrection of cylinder as the preoperative myopia increased.
- Treating hyperopic astigmatism with the Chiron Technolas Keracor 116/117 laser and PlanoScan program (flying spot), Argento and coauthors reduced mean preoperative astigmatism of over 3.0 D to 0.5 D or less in their three patient groups. This report is unique in that astigmatic correction was achieved by steepening the flat meridian and LASIK was performed.

2. Each laser and delivery system requires its own unique nomogram. As a result, we as practitioners are heavily dependent upon the manufacturers, who must construct and bench test a theoretical nomogram, and upon the early investigators, who must refine the nomogram through clinical testing. For example, to correct -3.00 -3.00×180, the VISX Star laser is programmed to treat -2.82 -3.60×180, whereas for the Nidek EC-5000, the recommended ablation is -1.24 -3.98×180. For many of us, these nomograms must be further refined according to our own setting and procedures (such as altitude, humidity, epithelial removal technique).

3. Reporting astigmatic results is complex. Several parameters must be analyzed: mean arithmetic reduction, vector analysis, and, depending on the nature of the study, more sophisticated approaches such as Alpins' method, which calculates values such as target induced astigmatism, surgically induced astigmatism, difference vector, and various indices of success. As Danjoux and coauthors point out in their article, one cannot rely upon any single individual parameter to determine the success of astigmatic treatments.

4. There is still much to be done to assess the quality of vision produced by various ablation patterns.

- How are measures of visual function other than visual acuity affected? Is contrast sensitivity preserved? What about glare, particularly with larger pupils?
- What are the corneal topographic patterns produced by the ablation? How are corneal asphericity and other topographic parameters modified?
- What is the effective diameter of the ablation? For example, we know that some lasers produce astigmatic ablations with a diameter as low as 4.5 mm, requiring careful preoperative assessment of pupil size. Looking at the topographic maps in Argento and coauthors' paper, we see small central corrected zones of 4.0 mm or less

(especially considering the 1.5 D intervals in the color scale used in these maps). How do these patients function at night?

- Finally, how do we decide which device and approach is best for our patients? Obviously, it is too early to answer this question. Factors to consider will include the obvious outcome variables (efficacy, predictability, safety, and stability), practical matters (complexity of procedure, per procedure costs, and versatility—ability to treat both myopic and hyperopic astigmatism), and upgradability (e.g., will topographically determined ablations be possible?). One must also consider competing technologies (intracorneal ring segments, phakic intraocular lenses, etc.).

This is an exciting time to be involved in refractive surgery. With change occurring so rapidly, we must work hard to stay abreast of advances that might benefit our patients. In turn, the journal will continue to provide rapid publication of peer-reviewed articles such as the ones in this issue that enable us to make informed choices.

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