

Correcting astigmatism

by Lisa B. Samalonis Contributing Editor

Topics at ESCRS included methods of analyzing astigmatism, correcting irregular astigmatism, and considering LASIK patients with corneal grafts.

A group of experienced ophthalmologists gathered at the recent European Society of Cataract and Refractive Surgeons meeting in Amsterdam to discuss their experience handling astigmatism.

Astigmatism analysis

The Alpins method of astigmatism outcomes analysis enables the examination of results of astigmatism treatment by refractive and corneal measurements using vector analysis. Noel A. Alpins, MD, of New Vision Clinics, Melbourne, Australia, said that outcomes are more favorable when measured by subjective refractive rather than objective corneal values. "By examining various indices created by individual vector relationships, a comprehensive astigmatism analysis is completed," he said.

Researchers analyzed the data from more than 100 eyes that had undergone laser in-situ keratomileusis for correction of myopia and astigmatism. The data, which were provided by the *Journal of Cataract & Refractive Surgery*, included preoperative and 3-month postoperative values for manifest refractive and corneal astigmatism. Both individual and aggregate data analyses were performed.

Alpins found that a systemic error of undercorrection of astigmatism magnitude by 15% to 30% was common in the treatment of these 100 patients. "The principal cause of these shortcomings was individual patient level misalignment or healing factors. Parallel indices demonstrated spherical correction to be more effective than astigmatic correction," he said.

In another study, Alpins described a vectorial planning method of LASIK treatments that concurrently perfects topographical and refractive astigmatism outcomes. (The method applies to lasers that have the capability to treat asymmetrical toric ablations.)

Analyzing astigmatism

Douglas D. Koch, MD, professor and the Allen, Mosbacher, and Law Chair in Ophthalmology, Cullen Eye Institute, Baylor College of Medicine, Houston, said that several important aspects are needed to appropriately report astigmatic data, including:

Arithmetic analysis includes mean, standard deviations, and ranges of preoperative and postoperative values and their differences.

Vector analysis can be applied to calculate the surgically induced astigmatism for each eye.

Aggregate analysis can provide the mean cylinder and axis for the induced astigmatism and is a more meaningful description of the overall change in the treatment group.

Global indices, such as defocus equivalent, blur strength, and global index of correction, provide additional data for vector analysis.

Specific indices, such as the Alpins indices, provide additional detail that can enhance understanding of specific aspects of surgically induced change.

Koch said that while statistical analysis can be performed using standard approaches, bivariate analysis, trivariate analysis, and linear optics may offer new approaches for more sophisticated types of analysis and understanding.

He said that wavefront data provide a whole new realm of information. However, he advised avoiding combining all aberration data into a single RMS value, until the visual impact of each type or aberration is better understood.

The January 2001 *Journal of Cataract and Refractive Surgery* special issue on astigmatism discusses this topic further.

"Vector planning effectively addresses differing topography and wavefront refraction measurements for astigmatism treatment," Alpins said. "The visual outcome can be elevated to super vision by minimizing and regularizing corneal and refractive astigmatism in one surgical step."

The vector planning method addresses the prevailing limitations preventing the astigmatism from being eliminated. "The theoretical

technique simultaneously targets the maximum reduction and the regularization of both topographic and wavefront refractive astigmatism to achieve a visual outcome better than preoperative best-corrected visual acuity," he said.

Alpins said that the remaining astigmatism, measured topographically and by wavefront refraction, should be minimal and regular to achieve the best solution. "This astigmatism treatment is performed in one surgical process, along with the associated spherical correction," he said.

Correcting irregular astigmatism

By using the excimer laser in the phototherapeutic keratectomy mode, assisted by viscous masking solution of 0.25% sodium hyaluronate (ELASHY, Laservis Chemedica, ophthalmic line, München, Germany), surgeons can produce a more regular corneal surface and improve BCVA in patients with irregular astigmatism, said Jorge L. Alió, MD, PhD, of the Instituto Oftalmológico De Alicante, Alicante, Spain.

The procedure's aim is to produce a uniform regular corneal surface while improving BCVA. The use of a viscous masking agent increases the efficiency of the procedure by protecting the valley between the irregular corneal peaks, leaving these peaks exposed to laser treatment.

The series included 50 eyes with surgically induced irregular astigmatism. All the patients had had refractive surgery or corneal trauma. Irregular astigmatism developed postoperatively.

At 3 months postop, the irregular corneal surface was significantly improved in all cases. The superficial corneal surface quality improved from within 9.16% of 70.5% to within 10.38% of 75.6%. Six eyes lost 1 line of best-corrected visual acuity, three eyes lost 2 lines, and five eyes lost 3 or more lines. Mean UCVA improved from within 20/125 of 20/80 to within 20/100 of 20/63. "We obtained a hyperopic shift in 56% and myopic shift in 40% of eyes," Alió said.


After 6 months, the irregular corneal surface continued to improve in all cases. (For more information, see page 23.)

Corneal grafts

LASIK in corneal grafts appears to be safe and effective for refractive errors. However, the correction of spherical refraction is more predictable than that of astigmatism, said Risto J. Usitalo, MD, of the Helsinki University Eye Hospital, Helsinki, Finland.

In the study, 31 eyes of 29 patients with penetrating keratoplasty had significant refractive errors and astigmatism. Each eye underwent LASIK, 22 or more months after PK for the correction of ametropias with a preoperative mean manifest spherical equivalent (SE) refraction of within 3.2 D of -4.5 and a mean refractive astigmatism of within 1.8 D of -3.7. All patients were treated with the Visx Star excimer laser and Hansatome microkeratome. All patients who had astigmatism greater than 6 D received relaxing incisions before LASIK.

"The changes in the manifest SE refraction after LASIK showed an initial full correction, followed by a little regression and stabilization of refraction at 3 months after surgery, with insignificant changes thereafter," Usitalo said. "At the last follow-up, the mean manifest SE refraction was -0.9 ± 1 D, and the refractive astigmatism was reduced to a mean of -1.6 ± 1.3 D."

Eight eyes, or 25.8%, had a manifest SE refraction within 0.5 D of target refraction and 18 eyes, or 58.1%, were within 1 D of intended correction, he said. For the cylindrical refraction, 12 eyes, or 38.7%, were within 1 D of intended correction. BCVA was reduced by 1 to 2 lines in seven eyes, or 22.6%, and improved by 1 to 6 lines in 16 eyes, or 51.6%. 

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