

Targeted induced astigmatism:

Know what you're aiming for in astigmatism surgery

MELBOURNE—The refinement of astigmatic surgical techniques has inspired the development of a new concept in planning and assessing surgery: targeted induced astigmatism, or TIA.

Based on vector analysis of keratometric and spectacle astigmatism, TIA is at the heart of a computer software program that is the brainchild of Noel Alpíns, MD, in practice here.

Called the Alpíns Statistical System for Ophthalmic Refractive Surgery Techniques, or ASSORT, the program is expected to be marketed in the U.S. by Alcon Surgical, Inc., of Fort Worth, Tex.

ASSORT allows surgical planning and follow-up of individual patients as well as groups of patients, and provides also for analyses of cataract/IOL and glaucoma surgical results. The program won the 1993 Borland Challenge, an international technology competition sponsored by an Australia-based magazine.

Procedures such as astigmatic keratotomy and photorefractive keratectomy are designed specifically to induce an astigmatic change, Alpíns said. The prevailing concept of surgically induced astigmatism, he noted, is insufficient to the needs of the modern refractive surgeon.

"Using only surgically induced astigmatism doesn't give you enough information to analyze the changes that have occurred," he said. "We have to know not just what happened, but what we wanted to happen. If you don't know what you're aiming for, how do you know how much you've missed it by?"

Conventional analyses of astigmatism surgery, using methods described separately by Jaffe, Cravy and Naeser, assume that the target is zero astigmatism, Alpíns explained, when in fact the optimal result in an individual patient may be a compromise between corrections suggested by spectacle vs. corneal astigmatism.

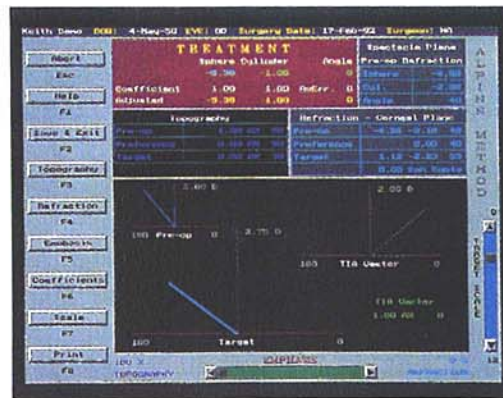
Whether to use spectacle or corneal astigmatism in surgical planning is a current controversy among those who are studying both laser and incisional astigmatic procedures. Employing a graphic display of the x and y axes, the ASSORT program shows the two vectors of spectacle and corneal astigmatism, and suggests a TIA that represents a compromise.

ASSORT has a built-in bias in favor of leaving unavoidable residual astigmatism near the with-the-rule meridian, where the eye-brain system can better handle it, Alpíns noted.

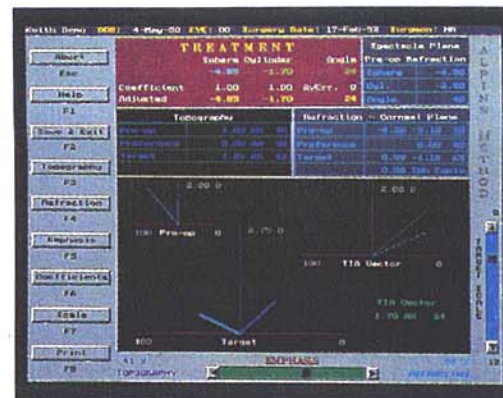
"As refractive surgeons, we have a preference to obtain zero astigmatism on the cornea and zero astigmatism



TIA for zero spectacle astigmatism.



TIA for zero corneal astigmatism.



TIA for optimal astigmatism result.

in the glasses," Alpíns said. "When there is a difference between the spectacle astigmatism and the corneal astigmatism, those preferences are on your wish list—they're mutually exclusive. You cannot achieve a spherical cornea and astigmatism-free glasses when you have a conflict between the spectacle astigmatism and the corneal astigmatism."

The astigmatic keratotomy surgeon who places his incisions on the steepest corneal axis gives 100% emphasis to his preference for a spherical cornea, Alpíns explained, and it is inevitable that astigmatism will remain at the spectacle plane. Conversely, the surgeon who does astigmatic keratotomy and places his incisions at the spectacle axis gives 100% emphasis to his desire to achieve no astigmatism at the spectacle plane, and residual astigmatism on the cornea is inevitable.

"My proposal is that when you calculate the targeted corneal astigmatism, it's going to lie somewhere between totally against the rule at axis 180 and totally with the rule at axis 90. What I believe is that we should individualize each patient's treatment according to where that targeted corneal astigmatism is going to fall."

For example, Alpíns noted, depending on where the TIA falls, the surgical procedure might give 50% emphasis to achieving a spherical cornea and 50% emphasis to eliminating astigmatism in the glasses. This leaves some unavoidable astigmatism at both planes.

"Philosophically speaking, there are many compromises in refractive surgery: whether we treat the center of the pupil versus the visual axis,

whether we aim for emmetropia or slight myopia in the spherical sense... Rather than denying the fact that there is a difference between the glasses astigmatism and the keratometric astigmatism, and saying to yourself, 'Well, the difference isn't very great, and they match pretty closely; it's probably lenticular in origin, so there's not much I can do about it,' what I'm saying is (see *Planning*, next page)

Planning

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that we have to address the issue."

The axis or amount of spectacle astigmatism differs from that of corneal astigmatism in almost all patients with naturally occurring astigmatic errors, Alpíns said.

In planning AK, for example, the use of TIA could alter incision placement. "My method addresses the corneal astigmatism that we're targeting, and that should be the overriding paradigm to determine where that incision should be placed on the cornea," Alpíns said. The optimal AK incision "doesn't necessarily lie on the steepest corneal axis, nor does it necessarily lie on the steepest spectacle axis, but on an axis to achieve the optimum target astigmatism."

The greatest potential for use of TIA is probably in laser refractive surgery, which is showing to be more

precise than incisional approaches, Alpíns noted.

The computations necessary to obtain and manipulate the TIA are too complex to do without a computer, Alpíns said. The ASSORT program will be available in IBM-compatible PC formats; graphics capabilities allow the incorporation of corneal topographic images.

The program can be used retrospectively and prospectively to analyze individuals and groups, and compare data over time.

The use of TIA is the key to future astigmatic surgery, Alpíns believes, and will optimize visual results.

"Our goal as corneal surgeons should be to try to minimize astigmatism and spherical aberration," he said. "These patients must live with their corneas for the rest of their lives."

No cost estimate on the ASSORT program is yet available. Alpíns has a financial interest in the product. ■