

Maximising astigmatism correction in cataract surgery



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MULTIPLE options exist for astigmatism correction in cataract surgery. At a session during the World Ophthalmology Congress 2008 chaired by Drs Noel Alpines and Stanley Chi, speakers provided pearls and discussed pitfalls associated with corneal incisional techniques and toric IOLs.

Rupert Menapace MD, Vienna University Eye Clinic, Austria, discussed strategies based on modulating the clear corneal incision (CCI). He recommended against creating a 3.0mm temporal CCI as it induces asymmetric ipsilateral sectorial flattening that encroaches on the 5.0mm optical zone. According to Dr Menapace, on-axis incisions are not effective in reducing astigmatism and do not improve visual outcomes compared to the temporal approach but cause significantly greater absolute torque and error of angle.

Dr Menapace cited favourable reports with opposite CCIs to predictably correct about 1.5 to 2 D of astigmatism. Corneal relaxing incisions can be effective, but exact alignment with regard to the corneal apex is mandatory and a guided keratome system is recommended to achieve a perfectly circular and perpendicular incision, he said.

Regarding arcuate keratotomy (AK), the full-arc depth dependent arcuate keratotomy proposed by Akura, a technique that uses longer incisions covering the whole bow-tie, appears promising for avoiding split change of topography and oblique axis change in case of imperfect alignment of the AKs. Limbal relaxing incisions (LRIs) have limited efficacy and can lead to corneal denervation, aggravating or inducing dry eye in elderly cataract patients, Dr Menapace said.

Toric IOLs offer an effective technique for correcting astigmatism. However, cost is an issue that needs to be considered, and the outcomes depend on exact axis alignment by the surgeon. Furthermore there is a potential for delayed IOL rotation.

"A technique in which the optic is buttonholed into a well-centred primary capsulorhexis to firmly hold the optic at four crossover points may obviate secondary rotation and provide perfect rotational stability," Dr Menapace said.

Superiority of temporal CCI

Edmondo Borasio MD, PhD, UK discussed on-axis versus temporal CCIs and reported the results of a study conducted at Moorfields Eye Hospital, London, comparing the two techniques. The trial enrolled 61 eyes of 50 patients who were randomised to CCI phacoemulsification through a 3.2mm temporal or on-axis CCI. Eligible

patients all had <2.6 D preoperative astigmatism, were operated on by one surgeon, and were implanted with Akreos Adapt IOLs.

The two incision techniques performed equally with respect to surgically induced astigmatism (SIA), final BCVA, final UCVA, and defocus outcomes. However, the on-axis incision was associated with more torque, which limits the benefit of placing the incision along the steeper meridian, noted Dr Borasio.

"The bottom line is, you may be used to doing it from the top, but doing it from the side is more convenient and less challenging," he concluded.

Benefits of microincisional cataract surgery

Burkhard Dick MD, Germany, addressed the issue of how cataract surgery technique, biaxial microincisional versus coaxial, affects astigmatism control. He conducted a prospective randomised trial comparing biaxial surgery performed through 1.1mm incisions and coaxial surgery using a 2.8mm incision with a 0.8mm paracentesis. The study enrolled 70 eyes.

Based on the results, Dr Dick concluded the standard coaxial technique is acceptable when implanting a toric IOL. However, the results showed the biaxial technique caused less induced astigmatism and did not cause changes in higher order aberrations.

"An alternate view is that the biaxial incision is totally inefficient for achieving astigmatic reduction. However, it is stable and safe, and I believe it is the ideal incision for implanting toric IOLs, and especially as we look to the future where we can expect to have light-adjusted lens technology and customised IOLs," Dr Dick said.

Dr Dick also observed that the goal should not be to completely eliminate residual astigmatism but rather to leave slight against-the-rule astigmatism to improve depth of focus and reading ability. He also indicated he prefers using the Scheimpflug digital imaging system (Pentacam, Oculus) for analysing the cornea because it measures true elevation points and provides useful information about the corneal wavefront. When performing biaxial surgery, he advocated a trapezoidal-shaped, two-step tunnel incision rather than a straight paracentesis as his preferred technique allows more lateral manoeuvrability and is self sealing.

Guidance from evidence-based medicine

In an ideal world, clinical decision making would be guided by evidence-based medicine. Michael Goggin MD, Queen Elizabeth Hospital, Woodville South, SA, Australia, undertook a literature review and

analysis to determine the breadth and strength of available evidence on non-laser treatments for astigmatism control in cataract surgery.

In a Medline search, he identified 26 randomised controlled trials published between 1985 and 2007. The majority included no more than 100 eyes. Twenty-two studies investigated phacoemulsification and only 19 of the total number subjected the data to vector analysis.

The study results showed:

- a superior phaco incision induces more SIA than a temporal phaco incision;
- corneal incisions are more astigmatically active than limbal incisions which cause greater SIA than scleral incisions;
- LRIs and AK are more effective than on-axis incisions;
- biaxial phaco incisions are less astigmatically active than coaxial incisions.

"Interestingly there were no randomised controlled trials on toric IOL outcomes, but I look forward to papers on this topic and comparing toric IOLs to incisional methods. We also need studies comparing the astigmatic effect of very small cataract incisions and the noise in routine keratometry. The question to be answered is whether when we are looking at such small effects, we are actually able to measure them," he said.

Practical pointers

Mark Packer MD, Oregon Health & Science University, US, discussed some practical considerations for surgeons using toric IOLs and LRIs for astigmatic correction.

First, Dr Packer emphasised the importance of knowing one's SIA. "SIA can be affected by the blade used, surgical technique and incision size. There are websites and software available for calculating this number, and its determination should be considered a starting point for any correction of astigmatism attempted at the time of refractive lens exchange or cataract surgery," he said.

For surgeons in the US, currently available toric IOLs allow a maximum correction of 2.3 D in the spectacle plane. Dr Packer noted that in his hands, he could correct up to 3.5 to 4.0 D of corneal astigmatism using LRIs. His technique involves cutting to 90 per cent of corneal depth based on pachymetry measured at the 10mm zone and using his own version of the nomogram developed by Louis Nichamin, MD.

When performing LRIs, Dr Packer suggested lubricating the epithelial surface using a small amount of dispersive

viscoelastic so that the incisions can be made smoothly without causing corneal abrasion.

"Surgeons performing LRIs also need to have an enhancement strategy to correct residual astigmatism, and for me that is LASIK," Dr Packer concluded.

Efficiency and safety with combined on-axis CCI, single LRI

Noel Alpines MD, Melbourne, Australia, discussed use of an on-axis CCI and a single, opposing (180 degrees away) LRI for astigmatism reduction. This minimalist approach, requiring one LRI instead of two, can derive up to 2.0 D of astigmatic correction and therefore represents a feasible option for 90 per cent of patients needing astigmatic control, Dr Alpines said.

"Paired on-axis CCIs are effective, but it is difficult to control the second opposing CCI, and this technique also involves penetrating the cornea in two places instead of one. A temporal CCI with paired LRIs also provides up to 2 D of correction, but it necessitates three incisions instead of two."

"On-axis CCI with a single opposing LRI is an effective, less invasive approach that is further simplified because it also eliminates the need to calculate off-axis effects." Vectorial calculations show that when treating astigmatism and being 15 degrees off axis, only 13.4 per cent loss of flattening effect occurs not 50 per cent loss as is commonly quoted, as this is only a comparison of pre- and postoperative astigmatism magnitudes and overstates the loss of effect.

Surgeons performing the on-axis technique with a single opposing LRI need to know their own SIA. Patients should have an accurate K value between 1.0 and 2.0 D and need to have a peripheral pachymetry measurement at the intended meridian to determine the depth of the LRI. To calculate the length of the LRI, Dr Alpines uses the Nichamin Age and Pachymetry Adjusted (NAPA) nomogram.

The horizontal refractive axis is marked with the patient in a seated position, and the LRI is taken to approximately 90 per cent corneal thickness.

"I prefer using a 3.0mm CCI instead of my standard 2.2mm incision as the longer incision provides greater astigmatic activity," Dr Alpines said.

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