Managing astigmatism during cataract surgery

About the participants

Symposium moderator William F. Maloney, MD, has basic describing and teaching the elements of refractive cataract surgery since 1984; with offices at Ste. A, 2323 West Vista Way, Vista, CA, 92083.

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A co-factoring couple with my nomogram can work in the surgeon’s favor, because one advantage is that arcuate incisions closely follow the OZ. They are equal throughout their depth. Patients are likely to get a more profound flattening in that meridian than you will with a simple transverse incision. Coupling phenomenon can be used to our advantage. If you have a patient who has a large degree of astigmatism, for which you need a single pair of AK incisions, we can anticipate that coupling will be close to one with arcuate astigmatic incisions. We are not going to affect the overall spherical component of the cornea by correcting the astigmatism and, do not have to change IOL power.

I prefer a triple-edged, square 1-mm diamond because it tracks the best when circumscibing the arcuate keratotomy. The maneuver is simple. Place the keratome in the edge of the mark, apply the cornea keeping the keratotomy edge, about 0.5 D, and gently rotate it with a rotation between the thumb and index finger until you inscribe the length of arc required. A square-edged blade tracks evenly within the stroma of the cornea and allows a much cleaner incision which is squared off at the end.

Maloney: Dr. Alpins, describe your thoughts about astigmatic correction at cataract surgery. How do you treat these patients?

Noel A. Alpins, MD: My standard incision is a 5.1-mm scleral tunnel incision, about 1.5 mm back from the anatomical limbus. I do a three-plane self-seating incision. At each meridian where the surgeon places the incision there will be a different flattening effect. When I place the incision superiorly I get the maximum amount of flattening effect, about 0.5 D. As I move that incision around to the temp...
less. As I move the incision toward the temporal side, the changeover occurs right around 300 in my meridians. My astigmatically neutral incision is at 30° in the left eye and 150° in the right eye. When looking at my results I was surprised to find my temporal incisions actually steepen the cornea. The mean for me is around about 0.2 D of actual steepening of the horizontal axis of the cornea. If I was going to operate on a patient who had against-the-rule incision, I would leave my incision 1.5 mm behind the limbus and de AK on a graduated basis or I would move that incision closer into the limbus. Every surgeon’s incisions have different constructions and effects, if I want to do an astigmatically neutral incision, I’m going to do it at 30° on the left eye and 150° on the right eye.

Kershner: Two factors contribute to this, getting further away from the OZ and blending between the superior and lateral rectus. You are having less gaping incisions. It is an anatomical phenomenon. All incisions onto the domed part of the cornea will act as if tissue has been added. Now you are talking about a scleral pocket off the dome of the cornea. All rules are off there. You have wound gaps. How much wound gaps are you going to get? If the wound gaps are greatest, you will have the most flattening. With scleral incisions, you can get two different phenomena from the same incision. It depends on what you do with your closure.

Alpins: Certainly the anatomy of the limbus varies in different places, you have a narrow limbus temporally and you have a wide one vertically. I use a technique where I use virtually no disinsertion so there is no contraction of tissue created in that way. You can get a certain amount of gaping but with ideally constructed incisions, without suturing, differences in astigmatic behavior do occur, even by the same surgeon operating on the same meridians. But there are trends evident.

For refractive cataract surgery, our surgical goal has moved from one of astigmatism neutrality to astigmatic reduction — whereas up until now we have been aiming for smaller and smaller surgically induced astigmatisms. We are trying to modulate our incisions directly to start achieving higher amounts of SIA to induce more changes from the incision. In the patients who have 1 D of astigmatism or less, you can still improve their astigmatic state by using the incision to reduce it by placing the incision on the steepest axis. You can choose an incision which, by your own experience, you will know how much effect to expect. You may, for example, choose a 60°-mm incision to give you the amount of flattening that is required for that cornea. That is why you will choose the tool that will reduce or increase the amount of astigmatism appropriately for that amount of preoperative astigmatism.

The trend now with astigmatic reduction as against astigmatic neutrality is to start using larger incisions rather than smaller incisions. When you start making larger incisions, it is a little less desire to start using softer and foldable implants.

Maloney: What percentage of patients are astigmatically neutral in your practice vs. those in whom you would consider a larger incision?

Kershner: I think that 50% of my patients have 1 D or less of against-the-rule cylinder and I will get less astigmatism effect from a neutral incision, so I have the best of both worlds. They have a small incision and it has an astigmatically beneficial effect.

Alpins: As other researchers have showed, in a myopic eye somebody between a 0.6- to 0.75D with-the-rule astigmatism is the most favorable for vision at distance and for reading, that is the best compromise between the two. Overall I would prefer an eye to have no astigmatism. The issue of overcorrection of astigmatism would not concern me if I was operating on a patient who was against-the-rule that I was concerned about, would I go for undercorrection or overcorrection? I would probably go for slight overcorrection to get this patient up toward slightly with-the-rule. It is optimally favorable to have with-the-rule astigmatism optically.

Maloney: Why do we go for that overcorrection and we get a little bit more than we expect we have 1 D and 2 D against in the rheum age?

Alpins: In my experience it is meridional shifts caused by astigmatic off-axis incisions that cause problems of adaptation. An axis shift caused by an on-axis incision will only change by 60° for an overcorrection as you say. Obtaining the full correction of astigmatism is as high a priority as the full correction of a significant spherical refractive error, in the expectation that the second eye is likely to require cataract surgery at some stage. If it is not anticipated soon, then the eye with 2-D against-the-rule astigmatism could undergo AK as a separate procedure. Because of these meridional shifts, it is all the more important to bring the refraction into the surgical plan and not to operate entirely on the shape factor and leave the refraction out. If you know where you are targeting for both the refraction and for the shape, then you have better control over the outcome.

One of the bigger problems with AK is the astigmatic undercorrection. I think the nomograms now available are excellent, enabling greater accuracy in there. I think that the identification of the steepest axis at the time of surgery is the next hurdle to overcome. I certainly bring my topography maps into the operating room, I have them on the side of the plasma machine, I look at them. I look at the eye. In the end, even though you look at the AK incision after the operation and you are pleased with it anatomically, these incisions sometimes don’t behave functionally as they should. AK is still a relatively gross operation to try to correct astigmatism because that patient’s astigmatism incision may have been on the right spot and yet the astigmatism did show some axis shift.

I also believe in doing AK to correct astigmatism at the time of surgery because I don’t think these patients appreciate two visits into the operating room. I will take 10 min off the pachymetry for my blades, setting with a double-edged blade and perform one or two arcuate cuts at the 7-mm meridian. I will choose the axis, once again as I mentioned a few moments ago, according to what I believe is to be the optimal balance between the topography and the refraction. I will bring the topography and the refraction into the surgical plan and this will help me decide at what axis to place the incision.

I prefer the target astigmatism to be with-the-rule. If it is not with-the-rule, it falls against-the-rule and I will lessen the effect on the cornea by targeting to a spherical cornea and leave that residual astigmatism (which you can avoid because of these differences), in the refraction.

Maloney: If you have a situation where there is a discrepancy between the preoperative topography and astigmatism by refraction, can we not be sure that the difference isn’t the result of lenticular astigmatism?

Alpins: By examining the oldest pair of glasses they’ve got. If these patients have got cataracts, there are going to be some changes in the last two or three years. If I am in any doubt about the versality of their refractive astigmatism, I will go with the topographic values. If those glasses are reliable as far as how long they’ve been used, and you can be satisfied that the refraction has been an accurate one I’ll take it into account.

If lenticular astigmatism was the only reason that we are getting these differences, then after less surgery all of these patients’ refractive and topographical astigmatism would be aligned, but they are certainly not. Lenticular astigmatism is not the answer.

I deal with residual astigmatism by the graphics and by examining where the target is, I can shift the icon around and determine the best place for that incision.

After placing the incision, the critical thing is then to look at all the results and see how all of those incisions are behaving at each of those axes. I see how much flattening or steepening is occurring at 45° axis steps. Then with the history of your last 20 incisions or your last 100 incisions, you know how an incision at that place will behave and then you can determine your targets more accurately and then you can target enemometry.

We talked about the difficult patient for access at 40° on the right eye and 160° in the left eye. My boundaries are 23° right to 81° left. For a left eye we have 170° I’ll go to 30° and right eye which is 45°, I’ll go to 220° and I’ll operate on the opposite side or meridian of the cornea. By going all the way down temporally and raising 45° on either side, I overcome those problems of the nose by operating infratemporally and do the analyses accordingly so that I determine my flattening and steepening profiles at all incision meridians.