Due to patient demographics, most glaucoma surgeons perform more combined glaucoma-cataract surgery than glaucoma surgery alone. Unfortunately, most glaucoma procedures induce astigmatism, which is in direct conflict with the surgeon’s intended outcome of cataract surgery: to provide a good refractive result. Despite this, patients undergoing combined glaucoma-cataract procedures expect refractive outcomes similar to those of cataract surgery alone.

The techniques used in glaucoma surgery naturally change the refractive state of the eye. For example, limbal scleral incisions for flaps, suture tension to prevent leaks or to stretch the trabecular meshwork, and large changes in IOP can all induce astigmatism. Surgeons have important tools that allow them to minimize these negative effects, including modifying the stitches or adding a limbal relaxing incision (LRI) when necessary; without intraoperative aberrometry, however, the effects of these measures are just best guesses. Surgeons with years of practice have an idea of how best to suture an eye, but they do not know the refractive outcome until after surgery.

With the development of intraoperative aberrometry, glaucoma surgeons can more precisely control the astigmatic effects of glaucoma surgery, potentially reducing or eliminating them. The only intraoperative aberrometer currently approved by the FDA is ORA (WaveTec Vision Systems, Inc.). Other companies have similar technologies in various stages of development.

**COMBINED SURGERY**

Glaucoma surgeons frequently pair glaucoma procedures with cataract surgery. This combination is convenient and effective for the disease processes, but it can lead to unpredictable refractive outcomes due to suturing, IOP changes, and the addition of astigmatism-inducing incisions above and beyond those needed for a typical cataract procedure.

The gold standard glaucoma procedure is trabeculectomy. The difficulty with this procedure is that cutting the scleral flap and tying the sutures on the surface of the eye can induce astigmatism. Because these changes are caused by surgery, astigmatic measurements made preoperatively are no longer accurate. Additionally, many endpoints for glaucoma surgeons are subjective; they tie sutures and determine appropriate tightness based on their experience. Prior to the availability of intraoperative aberrometry, ophthalmologists had no way of knowing if a suture were too tight until after surgery. Even with less invasive procedures such as canaloplasty or drainage devices, astigmatism can still be induced.

Intraoperative aberrometry can help the surgeon to understand the refractive change resulting from a particular glaucoma procedure. In response, he or she can exchange the original IOL for one with a different power to provide a more precise refractive outcome after cataract surgery.

In cases in which intraoperative aberrometry is used, the surgeon completes the glaucoma proce-
dure, remeasures the eye to see whether anything has changed from the preoperative calculations, and then completes cataract surgery. Detecting changes in the refractive measurement provides the surgeon with an opportunity to choose the best lens based on the refractive measurement after glaucoma surgery, thus maximizing the long-term result. It can avoid the need for a secondary procedure to correct astigmatism. Additionally, the surgeon has the option to implant a toric IOL in these patients, and they can still do well.

GLAUCOMA SURGERY AFTER LASIK AND IN HIGH MYOPIA

After LASIK

Glaucoma surgeons are seeing a growing number of post-LASIK patients who have developed cataracts. Previous refractive surgery makes cataract surgery on these eyes more complex, and if a patient had a great result with his or her prior surgery, he or she will expect an excellent outcome with this more complex combined procedure. It is important to minimize the unpredictability that glaucoma surgery brings to this type of case. Intraoperative measurements can be used to assess the refractive impact of the scleral flap and sutures and help determine any necessary steps to leave the patient with the best refractive result. It is easier to plan LRIs to counteract surgically induced astigmatism during glaucoma surgery than to have the patient return to the OR for an enhancement.

High-risk Cases

Certain other high-risk cases are also much easier with the advent of intraoperative aberrometry. For instance, patients with high myopia are considered a high-risk population: they tend to have a greater rate of glaucoma, because a thin cornea is a risk factor for developing the disease. Their eyes also tend to be larger and longer, and it is believed that there is a higher rate of pigment dispersion in this population.1

Eyes with myopia also may already have had a corneal refractive procedure to improve visual quality. If a glaucoma procedure becomes necessary, the lens power calculation is challenging, as it is in any eye after refractive surgery. A number of strategies have been described to calculate IOL power in eyes after refractive surgery, but intraoperative aberrometry measurements can be an additional aid in determining the correct lens power.

BEETR INFORMATION

Glaucoma is entering a new era, and several procedures, including minimally invasive techniques, are under investigation. Evaluating the refractive effects of these procedures with intraoperative aberrometry can help to uncover how much astigmatism they induce, and comprehensive reviews of the charts of patients undergoing these newer procedures will provide surgeons with a quantitative guide for what to expect. In return, surgeons can then compensate for any refractive changes when picking lens implants or planning LRIs. This could signal a new era of information that will help ophthalmologists choose the best glaucoma procedure for each patient; they can decide between surgical options with the same ability to lower IOP but with different refractive impacts.

Intraoperative aberrometry measurements can also help surgeons bring the success of existing glaucoma procedures more in line with the success of cataract procedures. When glaucoma surgery is performed alone, ophthalmologists can modify suture tension or implement LRIs. When glaucoma surgery is combined with cataract surgery, on-demand refractive measurements will help the surgeon to make the best possible decision in regard to the lens’ selection. Ophthalmologists can do well by their patients by controlling their glaucoma surgically—and not at the expense of good, uncorrected visual acuity.

The impact of suture lysis and postoperative healing on refractive error is still somewhat poorly understood. Many glaucoma surgeons have not used intraoperative aberrometry yet, but by using the information obtained from this technology, ophthalmologists may be able to find ways to modify surgical techniques to create more astigmatically neutral outcomes. Suture tensioning and optimal positioning in the OR may lead to less postoperative intervention for therapeutic or IOP-lowering reasons as well. Information about intraoperative and early postoperative IOPs and the effects of sutures on refractive error can help to balance the desired IOP outcome with refractive error resulting from surgical manipulation.

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