Ophthalmology Management

PC-IOLs in patients with corneal disease

How to identify who is — and is not — a good candidate for presbyopia-correcting IOLs.

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Treating presbyopia, particularly in conjunction with cataract surgery, is frequently considered the "Holy Grail" of ophthalmology. Estimates reveal nearly 2 billion individuals suffer from presbyopia worldwide,[1] leading to a reduced quality of life and productivity loss.[2-4] With a growing arsenal of technology, increasing patient awareness of presbyopic treatments and long-term economic benefits of presbyopia-correcting intraocular lenses[5] (PC-IOLs) to treat these patients, it is more important than ever to understand who may be a good candidate for surgical presbyopia intervention.

An important subgroup of cataract patients to consider are those with corneal disease, as these patients are at higher risk for poor outcomes. Here, we will consider PC-IOLs in the setting of various corneal pathologies to determine when these lenses are appropriate.

Remember that corneal and ocular health are not the only factors when considering these PC-IOLs. Patient personality, expectations, goals, activities of daily living and overall physical health comprise a comprehensive approach in surgical counseling. This article, however, focuses solely on corneal factors.

PRESBYOPIA CONSIDERATIONS

Current IOL technology

IOL technologies that are currently FDA approved for the correction of presbyopia in the United States include multifocal (MF), extended depth of focus (EDoF) and accommodating lenses. While accommodating IOLs may not render some of the potential optical disadvantages of EDoF and MF IOLs, given their lack of multifocality, it is still a premium lens for which the patient incurs an additional cost. Thus, if conditions exist that may jeopardize a visual outcome or quality (such as those listed later in this article), the same precautions and contraindications apply.

Preoperative evaluation

All cataract surgery patients, regardless of IOL choice, must have proper corneal evaluation. Slit lamp biomicroscopy is the foundation of the examination, and careful attention should be given to all layers of the cornea.

Those considering PC-IOLs should be thoroughly evaluated for ocular surface disease. This preferably begins before seeing the patient, using one of the various validated dry eye questionnaires.[6] Fluorescein and rose bengal staining of the ocular surface should be employed, and tear film osmolarity and inflammatory marker testing along with meibography can be powerful adjunctive tests. Optical quality and the tear film should also be assessed.

While topography and tomography may not be required in all monofocal IOL cases, it is helpful for PC-IOL candidates in order to qualify corneal structure and ocular surface characteristics.[7] Ideally, both placido-disk and Scheimpflug devices should be used to assess the ocular surface, keratometry, magnitude and axis of astigmatism and posterior corneal characteristics. Traditional placido-disk devices are unable to image the posterior cornea, thus failing to accurately account for posterior corneal astigmatism and posterior elevation, which may lead to suboptimal outcomes, particularly with MF/EDoF toric IOLs.

POOR PC-IOL CANDIDATES

Overview

Cataract surgery and presbyopia correction are procedures aimed to improve patients' quality of life. Given that goal, it is imperative that surgeons not degrade the visual experience of any individual. Therefore, certain patients should not receive PC-IOL implants.

Corneal ectasia

PC-IOLs are contraindicated in cases of ectasia for several reasons. First, the goal of PC-IOLs is spectacle and contact lens independence. An ectatic cornea is unlikely to achieve said independence due to optical aberrations. Second, optical disadvantages of diffractive and refractive IOLs, such as glare, halos and increased higher-order aberrations (HOAs), are accentuated. Third, IOL power calculation is unpredictable, especially in moderate to severe disease,[8,9] which makes an acceptable visual outcome unlikely. Residual refractive error is the main reason for dissatisfaction in PC-IOLs,[10] which means patients with ectasia will be unhappy and likely require additional vision aids.

Irregular astigmatism

Often, irregular astigmatism falls into the aforementioned category of ectasia or some variant thereof. Other patients have scarring or surface lesions, which are discussed below. Irregular astigmatism cannot be corrected with PC-IOLs, including toric versions, so PC-IOLs should not be utilized.[11] If the astigmatism can be made regular, as in some cases described later, they may be reconsidered.

CANDIDATES AFTER CORNEAL OPTIMIZATION

Overview

In some cases, patients may not be candidates for PC-IOLs on initial presentation. However, interventions may be available in certain circumstances, after which candidacy can change. Each situation must be considered carefully with attentive patient education and thorough post-intervention re-evaluation.

Anterior basement membrane dystrophy and ocular surface lesions

Anterior basement membrane dystrophy (ABMD) may significantly alter keratometry, astigmatism parameters and IOL selection.[12] Between 2% and 43% of people have ABMD-like changes[13] and about 30% of them have recurrent corneal erosions.[14] These issues, and accompanying visual symptoms, make PC-IOLs a bad option for ABMD patients unless corneal health can be restored. Phototherapeutic keratectomy and superficial keratectomy are effective treatments for ABMD, but up to 13% of patients experience symptomatic recurrence.[15]

Small, peripheral pterygia or Salzmann nodules (SN) that do not induce astigmatism and have demonstrated prolonged stability may be acceptable for PC-IOLs.[11] Typically, though, these lesions also require surgical intervention beforehand as they too impact keratometry, astigmatism parameters and IOL calculations.[12,16-18] While surgery for these lesions is often successful, optically significant changes, such as scarring and astigmatism, can occur.

Furthermore, recurrence is not uncommon. Visually significant recurrences occur in 5% to 20% of SN[19] cases, and pterygia recur 10% to 30% of the time.[20,21] Patients with these corneal conditions may be candidates for PC-IOLs after the ocular surface is optimized, reasonable corneal stability is confirmed and the risk of recurrence is accepted.

Fuchs' dystrophy

Patients with Fuchs' dystrophy experience compromised vision secondary to guttae and corneal edema. The use of PC-IOLs in early Fuchs sets up future disappointment as the disease and its symptoms progress. In later stages, biometry becomes inaccurate.[22]

Further complicating the matter are known refractive shifts[23] and occasional signs of ectasia or loss of stromal tissue after endothelial keratoplasty (EK),[24] which may be necessary later on. With so many variables, existing Fuchs' is a contraindication for PC-IOLs.[11,24]

The scenario by which a patient with endothelial disease could become a candidate is after EK alone, specifically DMEK, with the patient having excellent vision, a stable graft and otherwise normal testing. While use of PC-IOLs after corneal transplantation has been discussed, no formal studies exist.[25,26] Again, thorough evaluation and adequate chair time are crucial in these circumstances.

DED and meibomian gland dysfunction

Ocular surface and tear film health impact quality of vision as well as quality of life.[27] With regard to presbyopia correction, dry eye disease (DED) is consistently found to be one of the main reasons for dissatisfaction with surgical outcomes when PC-IOLs are used.[10,28]

With that said, DED and meibomian gland dysfunction are not necessarily contraindications for PC-IOL technology.[11] Nevertheless, patients must first understand their condition and its relationship with their visual quality as well as their surgical outcome. Then, they need to be willing to adopt a comprehensive treatment regimen to address the underlying cause of their disease.

Improved, even pristine, ocular surface health can hopefully be achieved with subsequent reevaluation, including repeat corneal imaging and biometry.

Patients must also understand that surface disease is not cured and may even worsen after surgery. Continued visual quality with PC-IOLs may well depend on long-term maintenance of their ocular surface.

OTHER CONSIDERATIONS

Corneal scarring and keratoconus

Scars may not preclude patients from PC-IOLs. Surgeons should consider scar location, size and induced astigmatism.[11] Thought should also be given to scar etiology. If a potentially recurrent infectious keratitis caused corneal scarring, it is prudent to refrain from PC-IOLs, as future corneal changes could impact visual performance.

Certainly, in the setting of keratoconus or hydrops-induced scarring, PC-IOLs are contraindicated. Small, peripheral scars with normal keratometry may be acceptable, while large, central, astigmatism-inducing scars are also contraindications.

Prior refractive surgery

An increasingly frequent scenario is the cataract patient who underwent prior corneal refractive surgery (RS). Such patients can be eligible for PC-IOLs after diligent evaluation,[11] but there are caveats. First, IOL calculation is difficult in post-refractive eyes. Second, increased HOAs from prior RS, combined with aberrations from PC-IOLs, can further decrease contrast sensitivity and vision quality. Third, few studies have examined the use of PC-IOLs after RS, and outcomes have been mixed.[29] Finally, there are higher rates of post-operative enhancements and lower rates of acceptable visual outcomes.[29]

When evaluating post-refractive eyes for PC-IOLs, it should be standard practice to use modern resources such as the Barrett-True-K, the ASCRS post-refractive calculators or other validated methods, given the difficulty of IOL calculations. It is helpful to perform more than one calculation to both provide a comparison and assess precision of IOL predictions. Intraoperative aberrometry may also be helpful in these cases,[30] though studies show mixed results as to whether it is better than modern IOL calculations alone.[31]

Patients who have undergone lower levels of myopic correction may be better candidates for PC-IOLs, as they likely have fewer RS-induced HOAs. Also, EDoF lenses may be more forgiving in these scenarios given the smoother transition from distance to near vision. It is important to explain to patients during the decision-making process the lower rates of success with PC-IOLs after RS; agreement on a quality back-up plan can prove invaluable.

CONCLUSION

When discussing presbyopia technology, the approach to a patient's corneal health is not suited to a one-size-fits-all solution. Determining whether a patient with corneal disease is a good candidate for PC-IOLs requires a holistic understanding of the patient, rigorous preoperative evaluation, comprehensive education and, in some circumstances, prior intervention.

Ultimately, the goal is to provide patients with the opportunity to enhance not only their vision but also their quality of life, and the IOL with the greatest chance of achieving that goal should be used. **OM**

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