optical area and reducing glare may be adequate to compensate for this problem. In addition, in the future, lenses that are more biocompatible and avoid endothelial damage, even if touch occurs, may be desirable, and foldable anterior chamber lenses may be possible.

Also in this issue of the Journal of Refractive Surgery, Zaldivar and colleagues (pp 294-305) describe experience with a posterior chamber plate phakic IOL (dubbed an intraocular contact lens, or ICL) for myopic and highly hyperopic patients, manufactured by Staar. This IOL can be injected through a small incision that does not require sutures, but it does require at least two iridectomies—first, with treatment of the iris with an argon laser, followed by a YAG laser iridectomy. These iridectomies must be done a few days before implanting the IOL to minimize pigment deposits on the lens surface; they are intended to reduce the incidence of pupillary block glaucoma. The posterior chamber phakic IOL is based on the original Fyodorov sulcus support principle, but rather than being made of relatively bioincompatible silicone, is made of a HEMA-porcine collagen copolymer which appears to be significantly more biocompatible. Determination of the optimal lens diameter for a given eye is based on measurement of corneal diameter and is inexact.

The study of 124 highly myopic eyes of 85 patients had a mean follow-up of only 11 months, with some patients followed for too short a time to be meaningful, and only three followed for as much as 3 years. Although only 65% of the myopic eyes in this study had 12 months of follow-up and only 50% had 18 to 24 months of follow-up, the lenses seem to be well tolerated. Three patients had opacities of the crystalline lens, two of which were present preoperatively, and none of which were considered visually significant. There is a real possibility that this lens may rest on the crystalline lens, as suggested by ultrasound biomicroscopy. Certainly, longer followup is required to determine its effect, if any, on the crystalline lens. More than 10% of the eyes had at least transient ocular hypertension. Although the series presents the results of only one experienced surgeon, the findings suggest that this approach is likely to be a safe and viable approach to the correction of high myopia and hyperopia. However, endothelial cell counts, which would seem to be especially important for this type of lens that unfolds in a phakic anterior chamber, were not reported. Not all of the lenses used over the course of this study were identical due to a series of design improvements, indicating that both posterior chamber and anterior chamber phakic IOLs are evolving to optimize safety and efficacy.

The purpose of this editorial is not to suggest that excimer lasers are obsolete, or that one phakic IOL procedure is superior to another. It seems very likely to us that, in the future, phakic IOLs will offer a viable alternative to excimer laser surgery that may be less expensive, more stable and predictable, and perhaps even safer than tissue-subtractive procedures. The patients enrolled in these studies had very significant visual disabilities and much to gain from this surgery. As newer designs of these lenses become available and the insertion of such lenses becomes easier and of greater demonstrated safety, it is likely that they will be used for smaller refractive errors and will be able to be used by experienced cataract surgeons all over the world, without the need for complex technology.

Into Thin Air with Phakic Intraocular Lenses?
Scott MacRae, MD

It has always been a mystery why intelligent, fit individuals insist on taking risks mountain climbing—surely their motive is not just to see an enhanced view of the world. Sometimes the leaders of such expeditions may have clouded judgment, which was the case when five people died on their hypoxic descent after climbing Mt. Everest in May 1996.1 There are some parallels between treating high myopia with refractive surgery and high altitude mountain climbing. In both, the stakes are high, each needs to be planned carefully—knowing where potential dangers are and how to avoid them. The articles on phakic intraocular lens correction of myopia by Zaldivar et al (pp 294-305) and Baikoff et al (pp 282-293) in this issue of the Journal of Refractive Surgery emphasize the need for an approach tempered with experience and caution. In the provocative articles by Zaldivar and colleagues, one can explore the new frontier of posterior chamber IOL implantation in phakic eyes. In the first article, they treated 124 eyes with extreme myopia with a mean baseline spherical equivalent refraction of -13.38 D and achieved a 69% rate of eyes having a spherical equivalent refraction within ±1.00 D of emmetropia. The surgery had some complications, such as implant removal (4%), cataract extraction (1.6%), pupillary block glaucoma (4.8%), transient ocular hypertension (11.2%), and one
retinal detachment (0.8%) that resulted in 20/800 vision and 36% of eyes gained two or more lines of spectacle-corrected visual acuity, which suggests there is considerable room for visual improvement. However, spectacle correction of high myopia minimizes the image so a better comparison would be preoperative contact lens-corrected visual acuity and postoperative spectacle-corrected visual acuity.

Results for the 24 eyes treated for hyperopia reported by Davidorf et al (pp 306 to 311) appear less promising; 83% of eyes saw 20/40 or better preoperatively with spectacle correction, but only 63% of eyes saw 20/40 or better uncorrected postoperatively. There was a 12.5% incidence of pupillary block glaucoma. This was more than twice the 4.8% incidence of pupillary block glaucoma noted in the myopia group, and suggests that anatomic and ultrasonic studies are needed to reduce this complication. Only 8% of the hyperopic eyes gained two lines of spectacle-corrected visual acuity; one eye (4%) lost two or more lines of spectacle-corrected visual acuity related to pupillary block and neovascular glaucoma.

The excellent article by Baikoff and colleagues (pp 282-293) addresses the challenges of anterior chamber angle fixed phakic intraocular lens implantation, using a modified convex optic and multiflex Kelman design. In this study, the authors examined 35 of 134 eyes (26%) out to 3 years; 37% of eyes saw 20/40 or better uncorrected: 62% to 66% had refractions within ±1.00 D of emmetropia. There were 2.1% to 8.3% of eyes that lost two lines of spectacle-corrected visual acuity, but none lost more than three lines. This is similar to the rate reported in the Summit excimer laser PRK trials for the US FDA.

Baikoff and colleagues evaluated endothelial cell density and reported an acute cell loss rate of 3.8% shortly after the surgery, which subsequently decreased to 0.7% per year. Bourne has reported an endothelial cell loss rate of 0.6% per year² in normal eyes. Similarly, we have evaluated a small group of noncontact lens wearing patients and found the cell loss rate to be approximately 0.7% per year.³ The results of the Baikoff study of the ZB8M generation anterior chamber IOL are reassuring in this regard.

The series had complications, however. The implant was displaced in two eyes, exchanged in four eyes, and removed in three eyes. Four eyes had pupillary block glaucoma that was successfully treated. One of the 134 eyes in the study also had retinal detachment. The incidence of phakic retinal detachment was 0.25% in the Baikoff study and 0.7% in the Zaldivar study, neither of which were greater than the 0.68% predicted by Perkins in aphakic myopic eyes with more than -10.00 D.⁴

Importantly, both studies are relatively short-term with follow-up of 3 years or less and do not document the long-term risk of cataract acceleration or development. Cataract extraction can be complicated in high myopes because of the roughly ten-fold increase of retinal detachment in this aphakic and pseudophakic population.⁵ The long-term effects of pigment dispersion with the posterior chamber IOL and of iris retraction with pupil ovalization with the angle-fixed IOL also deserve documentation.

Ophthalmic surgeons such as Zaldivar, Baikoff, and their colleagues are leading a dramatic ascent on the mountain of high myopia. Experienced climbers know that the descent can be equally dangerous. The descent represented long-term follow-up and the safety and efficacy of phakic intraocular lens procedures. These studies leave the ophthalmic community wondering whether the risks are worth the accomplishment. Only time will tell us the success of this expedition "into thin air."

REFERENCES

Comparison of Refractive Corneal Surgery and Phakic IOLs

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This issue of the Journal of Refractive Surgery features articles and editorials on phakic intraocular lens implantation. As Neuhaus observes in his editorial, refractive surgery connotes corneal surgery to most ophthalmologists and patients: refractive keratotomy, excimer laser surgery, intraocular rings, or thermal keratoplasty. However, in the past decade, the concept of refractive surgery has broadened to include cataract surgery with its emphasis on refined intraocular lens power calculations and reduction of astigmatism (refractive cataract surgery), and penetrating keratoplasty.