With current knowledge, we cannot determine whether prophylactic treatment is indicated in candidates for refractive surgery.

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Refractive surgery has become popular for correcting ametropias, but it can lead to a variety of complications (Figures 1 - 4). Hofman et al, Sanders et al, and Feldman et al have described retinal detachment (RD) after radial keratotomy. Rodriguez and Camacho reported on 14 eyes (12 patients) that had either asymptomatic or symptomatic retinal breaks, subclinical and clinical rhegmatogenous RD (RRD), or both after corneal refractive surgery. Rodriguez et al, Barraquer et al, and Ripandelli et al have described RDs after refractive lens exchange for myopia correction.

Ruiz-Moreno and associates reported the results of a clinically controlled study to investigate the rate of RD after implantation of phakic anterior chamber intraocular lenses. In that report, there was a 4.8% incidence of RD after implantation of a phakic anterior chamber intraocular lens for the correction of severe myopia. Our own most recent series demonstrated much lower incidences of RD after implantation of a Visian implantable collamer lens (ICL; Staar Surgical, 0.7%) or an Artisan iris-fixated intraocular lens (Ophtec, 0%).

Laser-assisted in situ keratomileusis (LASIK) has become one of the most popular options for the correction of low to moderate myopia worldwide. Complications of LASIK that have been reported include optic neuropathy, undercorrection and overcorrection, flap displacement, epithelial ingrowth, flap melting, keratitis, retinal tear, RD, retinal phlebitis, corneoscleral perforation, retinal hemorrhage, macular hemorrhage, macular hole, serous macular detachment, choroidal neovascular membrane, reactivation of ocular toxoplasmosis, and irregular astigmatism.

This report reviews retinal complications that may occur after refractive surgery, with an emphasis on RD after LASIK.

A number of studies have described the occurrence of RD after LASIK. Ozdamar et al reported a case of bilateral RD associated with giant retinal tear after LASIK. Stulting and associates reported a case of RRD after LASIK for the correction of myopia. Faghihi et al reported an incidence of 0.082%, and Ruiz-Moreno and coworkers reported an incidence of 0.25% in myopic eyes after LASIK and mean BCVA of 20/45 after retinal repair surgery. Aras et al described

AT A GLANCE

- Although LASIK has become one of the most popular options for the correction of low to moderate myopia, various types of complications have been associated with the procedure.
- Because vitreoretinal surgery causes changes in corneal shape, thus damaging the refractive surgeon’s results, the author suggests that cryopexy, argon laser retinopexy, pneumatic retinopexy, or vitrectomy without a scleral band be performed when appropriate because these procedures tend not to change the shape or length of the globe.
- It is very important to inform patients that LASIK corrects only the refractive aspect of myopia. Vitreoretinal complications in these eyes will occur, and only careful, large, prospective studies in patients can determine whether the procedure exacerbates myopic pathology.
10 RDs in myopic eyes after LASIK, an incidence of 0.22%. Farah and colleagues reported on four eyes that had RRD within 3 months of LASIK for correction of high myopia.

One case report details the development of an inferior RD due to two inferior horseshoe tears diagnosed 14 hours after LASIK surgery in a patient with -13 D of myopia.

No causal relationship between LASIK and RD can be stated from these studies. LASIK may be associated with RD, particularly in highly myopic eyes. In myopic eyes, the yearly incidence of RD has been estimated to range from 0.015% to 0.075%, thought to be related to premature vitreous liquefaction and early posterior vitreous detachment.

Ruiz-Moreno et al studied the incidence of retinal disease observed in 9,239 consecutive eyes of 5,099 patients after refractive surgery, including LASIK. RD occurred at a mean 24.6 ±20.4 months after LASIK in 11 eyes (0.36%). We have previously reported a 2-year study including 29,916 eyes after LASIK for the correction of ametropias, both myopia and hyperopia. The incidence of vitreoretinal pathology at 24 months in our study was 0.06%, including 14 RRDs (Figures 1 and 2). The incidence of RRD after LASIK in our previous studies ranges between 0.04% and 0.05%.

In our 10-year follow-up study including a total of 11,594 patients, 22 eyes (19 patients) developed an RRD after LASIK. Patients underwent surgical correction of myopia of -1.50 to -10.00 D (mean -4.50 D). RD occurred between 1 month and 13 years (mean 31.6 months) after LASIK, with increasing frequency at longer follow-up intervals. The frequency of RRD was 0.05% at 1 year, 0.15% at 5 years, and 0.19% at 10 years. Patients were scheduled to be seen on postoperative day 1, at 3 and 12 months, and yearly thereafter. The clinical findings, frequency of RRD after LASIK, characteristics (evaluations of fundus drawings), and surgical outcomes of 22 eyes were presented in that report. Preoperative examinations included a thorough dilated funduscopy with scleral depression and treatment of any retinal lesion predisposing to the development of an RRD.

The average age in the 19 patients with RRD after LASIK was 41.8 (range, 22-70) years, and 12 (54.5%) were male. In this series, 1.5% required treatment of predisposing retinal lesions before LASIK, but no patients who developed an RRD after LASIK had had previous prophylactic treatment of peripheral retinal lesions. No patient had a history of any ocular surgery after LASIK. RDs were managed with vitrectomy, cryoretinopexy, scleral buckling, argon laser retinopexy, and pneumatic retinopexy. Vitreoretinal surgery to repair RRD after LASIK was performed at a mean of 34.8 days (range, 7 days to 3 months) after the onset of visual symptoms. The mean follow-up after retinal surgery was 8.7 years (range, 1 month to 12 years).

Final BCVA after surgery improved by 2 or more lines from preoperative value in 57.1% of eyes. Poor visual acuity (20/200 or worse) occurred in 31.8% of eyes. Reasons for poor visual acuity included epiretinal membrane, myopic maculopathy, development of proliferative vitreoretinopathy (PVR), and optic atrophy. Anatomic success after one surgery was 100%.

**CAN WE PREDICT RETINAL COMPLICATIONS?**

The incidence of vitreoretinal pathology after LASIK in our study ranged from 0.05% to 0.19% (annual incidence 0.02%). This number is much lower than the incidence of RRD in myopes in general. This finding may be explained by the fact that refractive surgery patients in the institutions involved underwent preoperative examinations including a very thorough dilated indirect funduscopy with scleral depression and treatment of any peripheral retinal lesion predisposing for the development of an RRD before LASIK. In this study, extensive lattice degeneration, flap tears, atrophic holes, and retinal tufts were prophylactically

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Figure 1. Fundus photo of a subtotal superotemporal and nasal macula-on RD after LASIK.

Figure 2. Postoperative fundus photo of a myopic eye that developed an RRD with PVR after LASIK. Vitrectomy and silicone oil injection were successfully performed.
treated regardless of symptoms. Such indication is justified by the fact that vitreoretinal surgery causes changes in corneal shape, thus damaging the refractive surgeon’s results. We suggest that cryopexy, argon laser retinopexy, pneumatic retinopexy, or vitrectomy without a scleral band be performed when appropriate because they tend not to change the shape or length of the globe. Another option in case of scleral buckling procedures is to remove the exoplants early, after ensuring that all breaks have sealed and that no RD is present.

Lin and Tseng recently published a study assessing the efficacy and safety of prophylactic laser photocoagulation for retinal breaks in myopic patients undergoing LASIK.\(^{18}\) Retinal breaks were identified and treated in 39 eyes (2%) of 32 patients (3%). During a mean 19-month follow-up, none of the patients developed RRD except one patient without retinal breaks who sustained ocular trauma 19 months after LASIK.

Chan et al\(^{34}\) suggested that pre-LASIK retinal examination might help predict locations of certain post-LASIK retinal lesions (breaks, RDs) that may develop in highly myopic eyes with pre-LASIK vitreoretinal pathology (lattice, breaks); however they also noted, prophylactic treatment of vitreoretinal pathology before LASIK does not guarantee the prevention of post-LASIK vitreoretinal complications.

Based on published data, we cannot determine whether prophylactic treatment is indicated in patients who are candidates for refractive surgery. At this time, it is not possible to scientifically determine whether peripheral retinal lesions should be treated differently from standard practice in a preoperative evaluation for LASIK. Most practitioners suggest that patients scheduled for LASIK be carefully examined with indirect ophthalmoscopy and scleral depression under pupillary dilatation to detect any myopic peripheral lesion that requires treatment before LASIK is performed. One could argue that this is prudent in myopes whether or not they undergo LASIK; given the potential of the procedure to exacerbate preexisting pathology, it might be wise to treat such pathology more aggressively.

Another important factor to take into consideration when we evaluate our state of knowledge in this area is the duration of follow-up. In our 10-year follow-up study, the incidence of RRD increased with time, with an annual incidence of 0.02%. It is possible that LASIK-induced trauma might accelerate vitreous liquefaction and that, over the years, these patients might have a higher incidence of RDs and other vitreoretinal problems. It is equally likely that, with the current practice patterns of shorter periods of follow-up, ophthalmologists may be unaware of this.

Macular diseases may be a relative contraindication to LASIK. Patients with high myopia and lacquer cracks in the
Patients with high myopia and lacquer cracks in the macula are at high risk to develop macular hemorrhage or CNV after intraocular pressure is raised with application of the suction ring during the procedure.

CONCLUSIONS

Serious complications after LASIK are infrequent. It is very important to inform patients that LASIK corrects only the refractive aspect of myopia. Vitreoretinal complications in these eyes will occur, and only careful, large, prospective studies in patients can determine whether the procedure exacerbates myopic pathology. Such studies must be performed using careful prospective examinations including determination of risk factors, echography of the vitreous, indirect ophthalmoscopy with scleral depression, and possibly photography and angiography of the macular region to determine whether the LASIK procedure can exacerbate pathologic changes in the myopic eye.

In addition, our most recent study shows that results may not be as good as expected after RRD surgery. Despite high anatomic success with one surgery, reasons for poor visual acuity included the development of epiretinal membrane, PVR, myopic maculopathy, and optic atrophy. Final visual acuity may be limited by myopic degeneration, amblyopia, or delayed referral to a vitreoretinal specialist.

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