Vitreoretinal surgery for macular hole after laser assisted in situ keratomileusis for the correction of myopia

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Aims: To describe the characteristics and surgical outcomes of full thickness macular hole surgery after laser assisted in situ keratomileusis (LASIK) for the correction of myopia.

Methods: 13 patients (14 eyes) who developed a macular hole after bilateral LASIK for the correction of myopia participated in the study.

Results: Macular hole formed 1–83 months after LASIK (mean 13 months). 11 out of 13 (84.6%) patients were female. Mean age was 45.5 years old (25–65). All eyes were myopic (range −0.50 to −19.75 dioptres (D); mean −8.4 D). Posterior vitreous detachment (PVD) was not present before and was documented after LASIK on 42.8% of eyes. Most macular hole were unilateral, stage 4 macular hole, had no yellow deposits on the retinal pigment epithelium, had no associated epiretinal membrane, were centric, and had subretinal fluid. The mean diameter of the hole was 385.3 μm (range 200–750 μm). A vitrectomy closed the macular hole on all eyes with an improvement on final best corrected visual acuity (VA) on 13 out of 14 (92.8%) patients.

Conclusions: This study shows that vitreoretinal surgery can be successful in restoring vision for most myopic eyes with a macular hole after LASIK.

Laser assisted in situ keratomileusis (LASIK) has become one of the most popular options for the correction of low to moderate myopia worldwide. However, vitreoretinal complications including endophthalmitis, retinal tear and detachment, retinal haemorrhage, and choroidal neovascular membrane have been reported.

Chan and Lawrence have reported three eyes of three myopic patients that developed a macular hole in one eye after bilateral LASIK or photorefractive keratectomy (PRK). Ruiz-Moreno et al recently reported a case of a macular hole in a myopic eye after LASIK. We previously reported in a letter to the editor 10 eyes (10 patients) with full thickness macular hole development after bilateral LASIK for the correction of ametropia.

This report describes the characteristics, and surgical outcomes in 13 patients (14 eyes) who developed a macular hole after bilateral LASIK for the correction of myopia.

RESULTS

We found 14 eyes (13 patients) with full thickness macular hole after LASIK. The macular hole formed 1–83 months after LASIK (mean 13 months). In 57.1% of cases it developed ≤6 months after LASIK, and in 28.5% of cases it developed 1 year or more after LASIK. Eleven (84.6%) patients were female. The mean age was 45.5 years old (range 25–65 years). All eyes with macular hole after LASIK were myopic (range −0.50 to −19.75 D; mean −8.4 D). Posterior vitreous detachment was not present before and was documented after LASIK in 42.8% of eyes (table 1). A vitrectomy was performed at a mean of 60 days (range 1 day to 6 months after LASIK).

Abbreviations: IC, indocyanine; LASIK, laser assisted in situ keratomileusis; OCT, optical coherence tomography; PRK, photorefractive keratectomy; PVD, posterior vitreous detachment; VA, visual acuity.
to 18 months) after the diagnosis of macular hole. Surgery closed the macular hole on all 14 eyes that underwent surgical management with an improvement on final best corrected visual acuity in 13 out of 14 (92.8%) patients (table 2). The mean follow up after surgery was 17.7 months (3–70 months).

Table 2 outlines detailed characteristics of the macular hole of our case series. The mean diameter of the macular hole was 385.3 μm, and the range was from 200 to 750 μm. A centric macular hole was found in all eyes. The macular hole was unilateral in 12 of 13 patients (although one of those patients had an impending macular hole (stage 1) in the fellow eye). A stage 4 macular hole was found in seven eyes (50%). There was absence of yellow deposits on the retinal pigment epithelium (RPE) of the macular hole in 12 eyes (85.7%). Twelve eyes (85.7%) lacked a surrounding epiretinal membrane (ERM). Twelve eyes (85.7%) had subretinal fluid surrounding the macular hole; four of those eyes (all with −10.00 D of myopia) had extensive subretinal fluid in the posterior fundus (table 1).

A vitrectomy closed the macular hole on all eyes with an improvement on final best corrected visual acuity (VA) on 13 out of 14 (92.8%) patients. Poor VA (20/200 or worse) occurred in four (28.5%) eyes as a result of associated extensive subretinal fluid in the posterior fundus, and cataract. Six (42.8%) eyes out of 14 eyes had a VA outcome of 20/100. Only four (28.5%) eyes out of 14 eyes had a VA outcome of 20/40 (table 2).

SELECTED CASE REPORT
A 30 year old woman (case 2), with −13.00 D of myopia in the right (RE) and −10.00 D in the left eye (LE), underwent bilateral laser in situ keratomileusis in June 2001. Six months after surgery, she noted the onset of blurred vision involving her LE. Retinal examination revealed a stage 4 macular hole in the LE (fig 1A) associated with a posterior pole retinal...
Our findings are not generalisable to all myopic eyes that undergo LASIK. However, myopia is a risk factor for macular hole formation. It is possible that vitreomacular interface changes occurring after laser in situ keratomileusis may predispose certain myopic eyes to form a macular hole. Nevertheless, there are not enough hard data in the literature to determine if these are just myopic holes that would have developed anyway regardless of LASIK.

OCT before LASIK may be helpful to identify those eyes at risk for the development of a macular hole. Chan et al. have recently introduce the concept of a stage 0 macular hole based on OCT observations of the vitreoretinal interface in fellow eyes of patients with unilateral idiopathic macular holes, and to evaluate the subsequent risk of progression to a full thickness macular hole. In a retrospective observational case series of 94 patients with a unilateral stage 2, 3, or 4 full thickness macular hole. They found that in 27 (28.7%) of 94 clinically normal fellow eyes, OCT detected an abnormality of the vitreoretinal interface but normal foveal anatomy. Eyes with severe and moderate vitreoretinal abnormalities seemed to share characteristic features on OCT that increased their risk of macular hole development (stage 0 macular hole). Univariate analysis revealed that the presence of a stage 0 macular hole was significantly associated with an almost sixfold increase in the risk of macular hole formation (relative risk: 5.8, 95% confidence interval: 1.16 to 28.61, p = 0.03). They concluded that a stage 0 macular hole has a normal biomicroscopic appearance clinically, but has salient features on OCT as a result of oblique vitreous traction. Optical coherence tomographic findings consist of a normal foveal contour and normal retinal thickness and must include the presence of a preterinal, minimally reflective, thin band inserting obliquely on at least one side of the fovea. The presence of a stage 0 macular hole in the fellow eye is a significant risk factor for the development of a second macular hole.

An important limitation of our study is that, owing to its retrospective nature, OCT was not performed before LASIK. In addition, follow up was not consistent and it is possible that patients who developed a macular hole after LASIK were seen by other ophthalmologists outside of our institutions. Thus, we did not attempt to determine the incidence of macular hole formation after LASIK.

In summary, we present 14 eyes of 13 patients with no presurgical sign of a macular hole, which developed a full thickness macular hole after laser in situ keratomileusis. Our study shows that vitreoretinal surgery can be successful in restoring vision for most myopic eyes with a macular hole after LASIK. Vitreoretinal interface changes may have a role in macular hole formation after LASIK for the correction of myopia. Future prospective investigation involving a large number of myopic eyes with ultrasonic or ocular coherence tomographic studies may be valuable for determining vitreoretinal interface changes before and after LASIK.

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