Although rare, macular complications can occur and can result in decreased vision.

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Refractive surgery aims to correct errors related to the refractive media of the eye by means including corneal reshaping with an excimer laser (PRK and LASIK), refractive lens exchange (RLE), and phakic IOL implantation. This article describes the preoperative macular conditions that can affect surgical outcomes and details the occurrence and management of postoperative macular complications following refractive surgery.

Myopia is more commonly related to retinal and macular pathology than is hyperopia. Pathologic high myopia is associated with macular lesions such as foveal retinoschisis and macular retinal detachment, macular hole formation, diffuse or patchy myopic macular degeneration, lacquer cracks, macular scars due to previous macular hemorrhage related to Bruch membrane breaks, and choroidal neovascular membranes.

Hyperopia is not usually associated with macular disease. In cases of hyperopia associated with anisometropia, even in the presence of an anatomically healthy macula, it is important to exclude amblyopia.

**Preoperative Assessment**

A full clinical assessment of the macula, including biomicroscopy and macular optical coherence tomography, should be included in the preoperative work-up of any patient being considered for refractive surgery. Further investigations such as fundus fluorescein angiography, indocyanine green angiography, and fundus autofluorescence imaging may be required in the presence of conditions such as diabetes, uveitis, and retinal pigment epithelium (RPE) changes.

In such cases, an assessment of the best potential final visual acuity should be performed, and a full discussion with the patient should take place, informing him or her of the benefits and potential risks of the proposed procedure.

**Macular Lesions**

After PRK, LASIK, and phakic IOLs. A number of complications following refractive surgical procedures have been reported in the literature; these include macular hemorrhage, lacquer crack formation, choroidal neovascularization, retinal vein occlusion, subhyaloid hemorrhage, and Valsalva-like retinopathy. There are also case reports and series describing macular hole formation after refractive surgery. Additionally, transient macular edema and serous macular detachment have been reported after refractive procedures. In one study, the reported incidence of choroidal neovascularization was 0.01% after PRK, 0.33% after LASIK, and 2.38% after phakic IOL implantation.

Lesions following LASIK are considered to result from the rapid changes of intraocular pressure (IOP) during application and release of suction, producing mechanical stress and causing ruptures of Bruch membrane in the cases of macular hemorrhages and choroidal neovascular membranes. In macular hole formation, it is suggested that the IOP increase during suction application causes mechanical changes to the vitreoretinal interface. It is also possible that shock waves produced by the excimer laser may play a role.

**Following lens extraction.** Cystoid macular edema (CME) is the most common macular problem compromising final visual outcome following cataract surgery. Other complications include new choroidal neovascular membranes in eyes predisposed due to dry age-related macular degeneration, drusen, or macular RPE changes.

Phakic IOL implantation, as an intraocular surgical procedure, can potentially cause CME, especially in eyes with chronic inflammation. However, this has not been reported in the literature. It is unlikely that implantation of a phakic IOL will cause any other macular pathology.
MANAGEMENT OF COMPLICATIONS

The management of macular complications depends on the nature, complexity, and severity of the lesions. CME following RLE and phakic IOL implantation—if not associated with diabetes or uveitis and in the absence of small, retained nuclear fragments—can initially be treated with topical steroids in combination with topical NSAID drops. If this fails, orbital floor injection of steroids can be considered. Patients with persistent CME should be referred to a retina specialist for further investigation and management.

Macular hemorrhage following surface ablation or LASIK should be investigated with fundus fluorescein angiography in order to establish its cause. For choroidal neovascular membranes, treatment options include photodynamic therapy and intravitreal injection of a vascular endothelial growth factor inhibitor. 22-28

Macular hole formation requires further work-up and possible macular hole repair surgery. A retrospective series 29 reported that the prognosis for closure of such macular holes is usually good; however, the final visual outcome was not favorable in that series of patients, with only 35.7% of 14 eyes that underwent surgery achieving a visual acuity of 20/40 or better.

CONCLUSION

Refractive surgery has evolved beyond excimer laser surface ablation procedures to include intraocular surgical interventions with the aim of providing patients with good UCVA. Macular complications of refractive surgery, although rare, can result in decreased vision, sometimes irreversible and permanent, causing significant distress and impairment.

Patients with preexisting macular lesions and patients at higher risk of complications, such as those with high myopia, preexisting lacquer cracks, history of previous macular lesions, and early macular RPE changes or drusen, should undergo a full and thorough assessment of the macula, including photography, optical coherence tomography, and fundus fluorescein or indocyanine green angiography if indicated, before a refractive procedure is undertaken.

The risks, benefits, and alternatives should be discussed in full with each patient, explaining that macular lesions can result in a possibly irreversible worsening of vision.

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