Cataracts induced by neodymium–yttrium-aluminium-garnet laser lysis of vitreous floaters

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ABSTRACT
Background Neodymium–yttrium-aluminium-garnet (Nd:YAG) laser vitreolysis has been proposed as a treatment modality for symptomatic vitreous floaters. The purpose of this paper is to report two cases of cataracts associated with posterior capsular compromise, induced by Nd:YAG laser vitreolysis for symptomatic vitreous floaters.

Method Case series.

Results Two patients who underwent Nd:YAG laser vitreolysis for symptomatic floaters, presented with decline in visual acuity in the treated eye after the laser procedure. At the slit-lamp biomicroscope, each patient was found to have a posterior subcapsular cataract in the treated eye, with obvious loss of integrity of the posterior capsule. These two patients underwent cataract extraction by the same surgeon via phacoemulsification. Both eyes were found to have a defect in the posterior capsule intraoperatively. In both cases, a three-piece acrylic intraocular lens implant was placed in the sulcus, achieving optic capture. The best-corrected visual acuity (BCVA) was 20/20 in both patients, at 1 month following the surgery. At 2 months, one patient had a BCVA of 20/15. The second patient maintained a BCVA of 20/20 at 3 months.

Conclusions Secondary cataract formation accompanied by loss of integrity of the posterior capsule is a potential complication of Nd:YAG laser vitreolysis for symptomatic floaters.

INTRODUCTION
Neodymium–yttrium-aluminium-garnet (Nd:YAG) laser has become a standard, accepted treatment modality for posterior capsular opacification.1 Nd:YAG laser is also deemed to be an effective way to perform laser iridotomy.2 Sohajda et al1 demonstrated that Nd:YAG laser could be effectively used to treat pupillary membranes, especially after cataract surgery.

The Nd:YAG laser’s application for vitreolysis is far less commonly described, compared with its frequent and accepted usage in the treatment of anterior segment pathology. Moreover, there are no large series that report its safety and efficacy. We report these two cases of patients who developed posterior capsular rupture and associated posterior subcapsular cataract after Nd:YAG laser vitreolysis for symptomatic floaters. To our knowledge, cataract development and posterior capsular compromise as a direct complication of Nd:YAG laser has not been reported.

Case #1
A 63-year-old white woman presented to our facility to the retina service, for an atypical posterior subcapsular cataract. About 1 week prior, she had undergone Nd:YAG laser vitreolysis by her ophthalmologist for symptomatic floaters. Immediately, she noticed a decline in vision. Her best-corrected visual acuity (BCVA) was 20/50 at presentation. At the slit-lamp biomicroscope, she was found to have a large central diamond-shaped opening in the posterior capsule, with associated posterior subcapsular cataract (figures 1 and 2). Besides the presence of vitreous floaters, the retinal examination was unremarkable. A combined surgical approach was planned with the anterior segment surgeon and the vitreoretinal surgeon. Hydrodissection was purposefully avoided. The cataract was successfully removed via phacoemulsification. A three-piece acrylic intraocular lens implant was placed in the sulcus with optic capture by the anterior capsulorhexis. A pars plana vitrectomy was performed by the vitreoretinal surgeon for vitreous prolapse through the posterior capsular defect. At 1 month after the procedure, patient achieved BCVA of 20/20. At 3 months’ follow-up, her BCVA was 20/15.

DISCUSSION
Symptomatic vitreous floaters are due to molecular changes that occur within the vitreous body that result in liquefaction of the vitreous gel, with...
subsequent aggregation of the collagen fibrils that are able to scatter light. Most patients with symptomatic floaters typically present after the onset of a posterior vitreous detachment, as the posterior cortical vitreous has a higher density of collagen fibrils, which are even more likely to scatter light.

The incidence of symptomatic vitreous floaters is more than likely to be under-reported and is likely more prevalent than previously thought. This has led to the pursuit of additional treatment modalities for symptomatic floaters such as Nd:YAG laser vitreolysis. Nd:YAG laser treatment for vitreous floaters remain off-label and is not Food and Drug Administration (FDA) approved. A literature search shows very few cases that report about the effectiveness of Nd:YAG laser vitreolysis. The purported rates of successful resolution of floaters range between 0% and 100%; however, both peer-reviewed literature and assertions on web-based non-peer-reviewed laser vitreolysis sites remain to be substantiated, and at present, only pars plana vitrectomy has proven to be effective. The largest and most recent series by Delaney et al of 39 eyes that underwent Nd:YAG laser vitreolysis, showed that only 38% of the eyes had a moderate improvement in their symptoms.

According to the Treatment Guidelines for the Ellex Ultra Q Reflex laser (available at Ellex.com), the recommendation is to start the treatment with a single pulse per shot and to set the energy level at between 2–2.5 mJ. These guidelines also recommend that most treatments are performed at between 2.5–4.5 mJ energy and to use 500 as the upper limit of number of shots per session.

The safety report of Nd:YAG laser vitreolysis is lacking as there are no clinical trials or large series available. In fact, there are no reports of cataract development after Nd:YAG vitreolysis in the literature. The Treatment Guidelines for the Ellex Ultra Q Reflex laser mention traumatic cataract as a possible complication and suggest to avoid doing the laser initially in phakic patients to avoid this risk while the technique is mastered but does not mention incidence or specific cases. Other

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**Figure 1** Patient was found to have a large central diamond-shaped opening in the posterior capsule with associated posterior subcapsular cataract. Slit-beam photograph.

**Figure 2** Patient was found to have a large central diamond-shaped opening in the posterior capsule with associated posterior subcapsular cataract. Retroillumination photograph.

**Figure 3** A large ovoid opening in the posterior capsule with associated posterior subcapsular cataract.

**Figure 4** A large ovoid opening in the posterior capsule with associated posterior subcapsular cataract. Retroillumination photograph.

complications from YAG vitreolysis have been reported. Cowan et al\(^7\) recently described three eyes that underwent Nd:YAG vitreolysis, which consequently developed open-angle glaucoma that was refractory to glaucoma laser treatment and maximal medical therapy.

We herein demonstrated that secondary cataract formation accompanied by loss of integrity of the posterior capsule is a complication of Nd:YAG vitreolysis for symptomatic floaters. It remains unclear in our cases as to whether the posterior capsule rupture occurred due to the laser being focused directly onto the posterior capsule, or due to another mechanism directly related to laser energy or spot size, since we did not perform the laser and did not have the laser parameters used in these treatments. Loss of integrity of the posterior capsule poses a challenge during phacoemulsification, as capsular loss could lead to a range of complications, including the lack of support for the intended posterior chamber intraocular lens.

As there are no prior guidelines, or ‘precedents’ in terms of approaching YAG-induced cataracts with posterior capsular rupture, the phacoemulsification was undertaken as a combined surgical approach with a vitreoretinal surgeon. Vitreous prolapse becomes almost inevitable in such scenarios. In both of these cases, the cataract was removed successfully with phacoemulsification without posterior migration of lens fragments. Hydrodissection was purposefully omitted, and only hydrodelineation was performed to allow for the phacoemulsification of the cataract; we recommend this approach during the cataract extraction of a similar Nd:YAG-induced cataract to prevent posterior migration of the lens fragments during phacoemulsification.

Pars plana vitrectomy was performed by the vitreoretinal surgeon for vitreous prolapse through the area of posterior capsular defect. While the anterior segment surgeon can successfully perform a limbal anterior vitrectomy (LAV) for vitreous prolapse, if the approach had been planned in conjunction with the vitreoretinal surgeon, the vitreoretinal surgeon may perform the vitrectomy from a pars plana approach. Gillig and Springs\(^8\) demonstrated that while LAV offers the ease of a limbal incision, it was associated with longer surgical times, more extensive vitrectomy and enlargement of the posterior capsular rent in comparison with a pars plana approach.

In conclusion, given the observation of this very serious and undesirable complication of secondary cataract with posterior capsular compromise, we recommend that the Nd:YAG laser vitreolysis should probably be a contraindication (be it absolute or relative) in phakic patients.

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