Lysis of Vitreous Strands with Neodymium: YAG Laser

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Eighteen eyes with vitreous strands adherent to the corneoscleral wounds of previous cataract surgery were treated with neodymium: YAG laser to lyse those strands. Twelve eyes were treated for management of cystoid macular edema (CME group); six eyes were treated for prophylaxis of possible CME (prophylactic group). In the CME group, visual acuity improved two or more lines in nine eyes (75.0%), and seven eyes had a post laser visual acuity of 0.5 or better (One eye had a pre-treatment visual acuity of 0.5 or better). In the prophylactic group, visual acuity was either maintained at the pre-treatment visual acuity of 0.5 or better. In the prophylactic group, visual acuity was either maintained at the pre-treatment level or improved in five eyes (83.3%) 18 months later following laser treatment. This procedure was complicated by retinal detachment in one case and the elevation of intraocular pressure over 10 mmHg in another case.

Key words: neodymium: YAG laser, lysis, vitreous strand, cataract surgery, cystoid macular edema.

INTRODUCTION

Vitreous incarceration in the corneoscleral wound after cataract surgery may cause cystoid macular edema (CME) due to inflammation, traction of the retina, and/or other unknown causes.1-4 Medical and surgical management have both been used to treat decreases in visual acuity caused by CME.

The use of neodymium: YAG (Nd: YAG) laser is an alternative surgical method for treatment of CME. The laser is capable of photodisruption of nonpigmented structures and has already been utilized for lysis of vitreous strands.5-8 The success rate, after this procedure with promising results defined by improvement of vision, has varied from 40% to 89%. Only one eye has been treated with Nd: YAG laser for the prophylaxis of the development of possible CME.

We used Nd: YAG laser to lyse vitreous strands adherent to corneoscleral wounds for both the management of CME and for prophylaxis of the possible development of CME. This report presents a summary of the procedure and the results.

SUBJECTS AND METHODS

Eighteen eyes of 17 patients (nine male, eight female) aged 43 to 81 years were included in this study (Table). Each eye had either vitreous strands or bands adherent to the corneoscleral wound from prior cataract surgery at the time of Nd: YAG laser vitreolysis. Seven eyes were aphakic, six had anterior chamber intraocular lenses, and five had posterior chamber intraocular lenses. The presence or absence of CME was
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<th>Post-Laser Visual Acuity</th>
<th>Coexisting Ocular Pathology</th>
<th>Complications</th>
<th>Follow-up (Months)</th>
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<td>Glaucoma</td>
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AC: Anterior Chamber Lens,
PC: Posterior Chamber Lens,
A: Aphakia,
RD: Retinal Detachment,
IOP: Intraocular Pressure,
*: elevation of IOP > 10 mmHg,
†: Poorly controlled glaucoma
judged clinically via indirect fundoscopy and/or slit lamp biomicroscopy with a Goldman lens. Cystoid macular edema was noted in 12 eyes (CME group) and had been diganosed two weeks to six years prior to the study. Six eyes (prophylactic group) had no clinical evidence of CME. However, these eyes also underwent Nd: YAG laser vitreolysis for prophylaxis of the possible development of CME.

All patients in the CME group were treated with either topical and/or subconjunctival steroids for the medical management of CME without significant clinical success. Two eyes had undergone surgical vitrectomy to remove the vitreous from the anterior chamber but had persistent vitreous strands adherent to the corneoscleral wounds following surgery. Two eyes had coexistent open-angle glaucoma.

In the prophylactic group, three eyes had open-angle glaucoma, one of which was poorly controlled.

Preoperative evaluation included assessment of visual acuity, intraocular pressure, and configuration of the vitreous strand. A Q-switched American Medical Optics Nd: YAG laser (model 100) was used to lyse the vitreous strands with direct application of the laser beam. An average of 66 applications (range = 13-176) were used to lyse the vitreous strands. The mean pulse energy level was 4.5 mJ (range = 1.5-11.9 mJ). Three eyes required a second laser treatment. Patients were followed up for a minimum of two months (range = 2-21.5 months) in the CME group and a minimum of four and a half months (range = 4.5-64 months) in the prophylactic group. A β-blocker ophthalmic preparation was routinely prescribed just before or after the treatment. In the CME group, topical and/or subconjunctival steroids were also prescribed after laser treatment.

RESULTS

The vitreous strands were lysed in all cases to some extent; complete lysis of the strands was achieved in 14 out of 18 eyes (78%). We did not attempt to completely lyse the strands in the remaining four cases for several reasons: good visual recovery after the first vitreolysis, patient lost to follow up, hazy cornea, and complete resolution of CME with a subsequent development of retinal pigment epithelial change.

In the CME group, nine eyes (75.0%) improved at least two lines of visual acuity, and seven of the 12 eyes demonstrated a post laser visual acuity of 0.5 or better (Fig. 1). Only one eye had a visual acuity of 0.5 or better before laser treatment. The visual acuity of one eye remained unchanged. In one eye, vision fluctuated between 0.3 and 0.5 for the initial four months after laser treatment and subsequently diminished to 0.05 due to the development of corneal graft failure. In all eyes, except this latter case, where macular status could not be assessed, the CME resolved to some degree after vitreolysis with a complete clinical resolution in five eyes (41.7%). Figure 2 demonstrates the relationship of post-laser visual acuity to the status of the CME. Several eyes had good vision in spite of residual CME. There appeared to be little relationship between the duration of CME and post-laser

![Fig. 1. Post-laser visual acuity in the CME group.](image)

![Fig. 2. The relationship of post-laser visual acuity to the resolution status of CME.](image)
visual acuity ($r = 0.003$), perhaps because of the relatively small sample size (Fig. 3).

Of the six eyes which were treated prophylactically, the visual acuity of four eyes (66.7%) remained unchanged during at least 18 months of follow-up, and the vision of one eye improved from 0.4 to 0.8 after the lysis of an opaque vitreous strand (Fig. 4). Visual acuity decreased from 0.3 to 0.06 in the one eye which had poorly controlled glaucoma.

In one case, which had ocular trauma resulting in corneal laceration and vitreous loss two and half months prior to laser vitreolysis, retinal detachment occurred two weeks after Nd: YAG laser vitreolysis and was successfully managed surgically. Intraocular pressure was elevated in one eye from 11 mmHg pre-laser to 43 mmHg post-laser. The pressure subsequently returned to the normal range within one day. Transient iritis occurred in three eyes, and transient iris hemorrhage occurred in one eye.

**DISCUSSION**

Iliff$^9$ originally treated CME associated with vitreous strands to cataract wounds (coining the phrase “vitreous tug syndrome”) with a bent 30-gauge needle. Since that time, various surgical modalities have been utilized to cut these vitreous strands.$^{10,11}$

After introduction of the Nd: YAG laser to the ophthalmic field, Katzen et al.$^{5,6}$ utilized the Nd: YAG laser to lyse the strands of vitreous adherent to cataract wounds. In their first series,$^5$ vision improved by variable degrees in all 14 patients treated. In their report,$^6$ the visual acuity of 40 eyes improved at least two lines (89%), and 45 eyes (82%) attained a visual acuity of 0.5 or better. Steinert and Puliafito$^7$ describe the results of anterior vitreolysis with Nd: YAG laser in 14 patients with angiographically proven CME. They found that vision improved at least two lines in 12 cases (85.7%). In 1987, Levy and Pisacano$^8$ reported their results with vision improved two or more lines in 40% of the cases studied.

This current study demonstrated an improvement in visual acuity of two or more lines in 75.0%, and visual acuity of post-laser was 0.5 or better in 58.3% of the CME cases. Even though the possibility of spontaneous resolution of CME cannot be totally eliminated, it is unlikely that 75.0% of the eyes, which had already been treated with steroids without any significant success, would show spontaneous improvement in vision. Furthermore, in the prophylactic group, except for the one eye which had poorly controlled glaucoma, the visual acuity either remained unchanged or improved after at least 18 months of follow-up (83.3%). Our study indicated the apparent efficacy of Nd: YAG laser vitreolysis to treat or prevent the development of CME.

Lysis of the vitreous strands was achieved in 77.8% of the cases. If the laser beam had been reapplied in the partially lysed eyes, the vitreous strands probably could have been lysed completely. We did not attempt to completely lyse the
vitreous strands in these cases as already discussed. In our series, there appeared to be no relationship between post-laser visual acuity and the status of CME after laser treatment \((p = 0.5)\) or the duration of CME before laser treatment \((p = 0.9)\). A larger patient population should be studied, however, for more significant statistical evaluation.

We judged the presence or absence of CME clinically. Fluorescein angiography is the most reliable method for detecting CME. However, 78% of angiographically proven CME patients have 1.0 vision.\(^\text{12}\) Also, 86.2% of angiographic CME has been shown to resolve spontaneously within six months.\(^\text{13}\) Hence, as discussed by Strak\(^\text{12}\) and Yannuzzi,\(^\text{14}\) we felt a clinical assessment of CME was more appropriate for this study.

Interestingly, no serious complications of this procedure were reported in a previous series. However, we encountered one case of elevated IOP and one case of retinal detachment. This is compatible with the many reports of the use of Nd: YAG laser in the anterior segment which describe a high incidence of elevation of IOP\(^\text{15-17}\) and sporadic occurrence of retinal detachment.\(^\text{18, 19}\) The exact mechanism of the elevation of IOP is not fully understood. It is also difficult to explain the occurrence of retinal detachment after laser vitreolysis, although the severe ocular trauma in our case, which had occurred three months before the retinal detachment, may have been a more significant causative factor than the laser vitreolysis. It is possible that the combination of ocular trauma and vitreolysis induced retinal detachment while neither of them would have induced retinal detachment individually. The mechanism and incidence of retinal detachment after laser vitreolysis, however, needs further study.

This procedure of Nd: YAG laser vitreolysis has several advantages over surgical vitrectomy. Intraocular surgery can aggravate CME and may be complicated by infection. Persistent vitreous strands may adhere to the wound even after complete anterior vitrectomy, as was the case in two eyes in our series. Laser vitreolysis may also be used in cases of medically intractable CME with the vitreous strands, as was evidenced by previous studies.\(^\text{5-8}\) Medical treatment appears to be ineffective in the treatment of CME caused by incarcerated vitreous strands without prior lysis of incarcerated strands. Furthermore, lysis of the vitreous strands via laser may provide an effective prophylactic treatment for possible CME. This report supports a previous series demonstrating the high efficacy of this procedure, although complications are duly noted. Nd: YAG laser vitreolysis is a viable alternative treatment of vitreous strands adherent to the corneoscleral wound.

REFERENCES


