Focal double-frequency yttrium-aluminum-garnet laser in central serous chorioretinopathy resistant to intravitreal bevacizumab

Ahmed Mohammed Ali Elbarky, Tarek Roshdy Elhamaky
Department of Ophthalmology, Benha Faculty of Medicine, Benha University, Benha, Egypt

ABSTRACT

Purpose: The purpose of this study was to evaluate the effect of focal double-frequency yttrium-aluminum-garnet (YAG) laser therapy in patients with central serous chorioretinopathy (CSCR) resistant to intravitreal bevacizumab (IVB) injections. Methods: This is a retrospective analysis of 16 eyes of 16 patients with CSCR of >3 months duration who had been previously treated with multiple injections of bevacizumab (average 2.7) with no improvement in best-corrected visual acuity (BCVA). All patients had been treated using multiple spots of focal double-frequency YAG laser over areas of focal and diffuse leak. Spectral domain-optical coherence tomography (SD-OCT) was done a day before laser treatment and at 1, 3, and 6 months after. Fluorescein angiography was done for all patients to locate leakage site before laser treatment. Reduction in subretinal fluid height on SD-OCT was used to measure the response to treatment. Results: Mean age of patients was 37.6 ± 3.9 years. The baseline BCVA was improved significantly (P < 0.001) from 0.39 ± 0.45 logarithm of the minimum angle of resolution (log MAR) to 0.11 ± 0.43, 0.10 ± 0.44, and 0.09 ± 0.45 (log MAR) at 1, 3, and 6 months posttreatment, respectively. The baseline OCT mean central macular thickness decreased significantly (P < 0.001) from 554 ± 45 μm to 285 ± 38 μm, 279 ± 34 μm, 275 ± 33 μm at 1, 3, and 6 months posttreatment, respectively. Conclusion: Focal double-frequency YAG laser therapy improved the BCVA and reduced neurosensory detachment in patients with CSCR resistant to IVB injections.

Keywords: Argon subthreshold laser, bevacizumab, resistant central serous retinopathy

Introduction

Central serous chorioretinopathy (CSCR) is a generalized disease of the retinal pigment epithelium (RPE) and choroid. Fluid leakage from the choroid into the subretinal space results in the accumulation of fluid under the pigment epithelium and retina.[1,2] Various theories have been proposed for fluid accumulation including focal imbalance of RPE ionic transport system and elevated choroidal pressure.[3] The disorder...
predominantly affects men in their middle ages or even younger. Suggested risk factors include psychological stress, tobacco use, and Type A personality. Rapid deterioration of vision is the main complaint in majority patients. In addition to visual deterioration, micropia, dyschromatopsia, and metamorphopsia are common symptoms. Most of the cases have self-limiting courses. Treatment for nonresolving CSCR cases is controversial. Maumenee described the concept of a leakage site within the retinal pigment epithelial layer following fluorescein angiographic (FA) studies in patients with CSCR. Since then, laser application to the site of leakage (direct laser photocoagulation) has become the commonly used treatment modality. Laser photocoagulation shortens the duration of the disease by 2 months and also reduces the recurrence rate with no change in the final visual outcome. To seal the leakage, the site is identified with FA and treated with Grade I laser burns. Although rapid improvement is usually observed after laser application, in some cases, it may lead to a macular scar, secondary choroidal neovascularization, and central or paracentral scotoma. It is postulated that subthreshold laser can have the same advantageous effects without damaging the delicate macular tissue. Verma et al. demonstrated improvement in vision and contrast sensitivity in their clinical trial using a subthreshold diode laser. Vascular endothelial growth factor (VEGF) was formerly known as “vascular permeability factor” and has profound effects on vascular permeability. It follows that VEGF blockade may ameliorate the choroidal hyperpermeability present in CSCR. There is some controversy regarding the ability of bevacizumab to penetrate the retina and reach the choroid; however, reports suggest that it indeed does so, which supports the possibility that an intravitreal injection of bevacizumab may be biologically active in areas of the choroid.

Comparative studies between anti-VEGF therapy and photodynamic therapy (PDT) treatment have been proposed. Semeraro et al. report the effectiveness and safety of intravitreal bevacizumab (IVB) injection compared with low-fluence PDT (L-PDT) in eyes with chronic CSCR. Bae et al. in their study of L-PDT versus Ranibizumab for chronic CSCR found that half-fluence PDT might be superior to intravitreal ranibizumab as a treatment for chronic CSCR.

The purpose of this study is to measure the improvement in vision in patients with CSCR not responding to IVB after focal double-frequency yttrium-aluminum-garnet (YAG) laser therapy.

Methods

This was a noncomparative retrospective interventional study.

Inclusion criteria

Inclusion criteria include persistent CSCR with duration of 3 months or more; center-involving neurosensory detachment and presence of active angiographic leakage in FA, previously treated with multiple injections of bevacizumab (average 2.7) with no improvement in best-corrected visual acuity (BCVA).

Exclusion criteria

Exclusion criteria include CSCR with subfoveal leak, use of exogenous steroid, decrease in visual acuity due to causes other than CSCR, any hereditary retinal or macular disease, history of intraocular surgery and prior pan-retinal laser photocoagulation or macular laser photocoagulation.

All patients underwent a comprehensive ophthalmic examination including BCVA testing, slit-lamp biomicroscopy, intraocular pressure measurement using Goldmann applanation tonometer, and dilated fundoscopic examination.

Imaging

Spectral domain-optical coherence tomography (SD-OCT) was done a day before laser treatment and at 1, 3, and 6 months after treatment.

FA was done for all patients to locate leakage site before laser treatment.

Laser therapy technique

Laser therapy was performed for all patients using focal double-frequency YAG laser (532 nm). Laser parameters were set as to achieve grayish white burn, spot size 50–100 μm, and pulse duration 0.02–0.05 s. The laser was applied to leaking site seen on FA.

Primary outcome measure was the resolution of neurosensory detachment at 1, 3, and 6 months of follow-up on SD-OCT. Secondary outcome measure was change in BCVA score at 1, 3, and 6 months compared to baseline.

Statistical analysis

Visual acuity was measured as logarithm of the minimum angle of resolution (log MAR) for statistical analysis. To analyze the change in BCVA and CMT at baseline and at 1, 3, and 6 months follow-up, paired Student’s t-test was used. A P value of 0.05 was considered statistically significant.

Results

A total of 16 eyes of 16 patients were enrolled for this retrospective study. The mean age of patients was 37.6 ± 3.9 years with 10 (62.5%) males and 6 (37.5%) females. All patients were followed up for 6 months.
The FA pattern was ink blot in 11 patients (68.7%), smoke stack in 3 patients (18.7%), and diffuse leakage pattern in 2 patients (12.5%). All cases showed complete resolution of neurosensory detachment at 1 month of follow-up on SD-OCT. The baseline BCVA was improved significantly ($P < 0.001$) from 0.39 ± 0.45 log MAR to 0.11 ± 0.43, 0.10 ± 0.44, and 0.09 ± 0.45 log MAR at 1, 3, and 6 months posttreatment, respectively. The baseline OCT mean central macular thickness (CMT) decreased significantly ($P < 0.001$) from 554 ± 45 μm to 285 ± 38 μm, 279 ± 34 μm, 275 ± 33 μm at 1, 3, and 6 months posttreatment, respectively [Table 1 and Figures 1, 2]. Figure 3 shows prelaser FA, prelaser SD-OCT, 1 and 6 months post-laser SD-OCT.

**Discussion**

Available treatment methods for CSCR include continuous-wave conventional laser thermal photocoagulation, PDT, and micropulse diode laser.\(^{[16-19]}\) PDT, although sometimes effective in chronic cases, is expensive and can be associated with RPE atrophy and choroidal neovascularization.\(^{[20]}\)

Laser photocoagulation therapy for CSCR was first reported by Watzke et al., showing that it can be effective in shortening the disease period.\(^{[21]}\) The mechanism of subretinal fluid resolution after laser photocoagulation treatment is controversial. Proposed mechanisms include the sealing of focal defects in the RPE, promoting a healing response and recruitment of healthy RPE cells, or directly stimulating the pumping function of RPE cells near the leak.\(^{[10,11,22]}\) In general, it seems that subthreshold laser improves metabolism of the RPE cells and therefore accelerates resorption of the subretinal fluid which in turn leads to less photoreceptor damage. Improvement of patients’ vision to its initial level has been shown by the previous reports.\(^{[18]}\)

This study reveals clinical improvement in BCVA and statistically significant reduction in mean CMT following focal argon in CSCR.

In this study, we applied focal double-frequency YAG laser for the treatment of CSCR not responding to IVB to evaluate its efficacy. We found that the baseline BCVA was improved significantly ($P < 0.001$) from 0.39 ± 0.45 log MAR to 0.11 ± 0.43, 0.10 ± 0.44, and 0.09 ± 0.45 (log MAR) at 1, 3, and 6 months posttreatment, respectively. The baseline OCT mean CMT decreased significantly ($P < 0.001$) from mean pretreatment 554 ± 45 μm to 285 ± 38 μm, 279 ± 34 μm, 275 ± 33 μm at 1, 3, and 6 months posttreatment, respectively.

Various studies have established the role of laser in no resolving CSCR. Robertson and Ilstrup showed no

---

**Table 1: Mean best-corrected visual acuity and central macular thickness changes in the treated patients**

<table>
<thead>
<tr>
<th></th>
<th>Mean ± SD</th>
<th>1 month postlaser</th>
<th>3 month postlaser</th>
<th>6 month postlaser</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCVA</td>
<td>0.39 ± 0.45</td>
<td>0.11 ± 0.43</td>
<td>0.10 ± 0.44</td>
<td>0.09 ± 0.45</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CMT, mean (μm)</td>
<td>554 ± 45</td>
<td>285 ± 38</td>
<td>279 ± 34</td>
<td>275 ± 33</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

SD: Standard deviation, BCVA: Best-corrected visual acuity, CMT: Central macular thickness
recurrences in a “direct” laser group at up to 18 months of follow-up.[10] Chhablani et al.[12] found that complete resolution was achieved in 15 out of 16 eyes at 2 months.[12] However, the CMT had significantly reduced in the remaining one eye. A study by Lim et al. reported resolution of fluid at 1 month after conventional laser in 7 out of 12 eyes; however, all the eyes had a resolution of fluid by month 3. In this study, complete resolution was achieved in all patients up to 6 months of follow-up after laser treatment.[23]

Chhablani et al., who used navigated focal laser photocoagulation for treatment CSCR, did not find any significant difference between the visual acuity at baseline and after resolution of neurosensory detachment.[32] Similar results were reported by other authors, previously.[29] However, this study showed correlation between improvement in the visual acuity at baseline and resolution of neurosensory detachment. Subthreshold diode laser micropulse photocoagulation was superior to intravitreal injections of 1.25 mg bevacizumab in the treatment of CSCR, which resulted in enhanced visual acuity and macular perimetry.[24]

We have found focal double-frequency YAG laser to be an effective modality in the management of CSCR resistant to IVB therapy. There was a significant anatomical and functional improvement in the treated eyes of this study. Among other modalities treatment, argon subthreshold laser is available, simple, and less expensive.

**Conclusion**

Focal double-frequency YAG laser improved the BCVA and reduced neurosensory detachment in patients with CSCR resistant to IVB injections.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**


