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Case Report

Focal Laser Photocoagulation for Central Serous Chorioretinopathy in Under-Represented Populations: A Retrospective Case Series

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Keywords
Central serous retinopathy · Central serous chorioretinopathy · Focal laser photocoagulation · Subretinal fluid · Choroidal neovascularization · Under-represented groups

Abstract
This case series examines visual and anatomic outcomes of focal laser photocoagulation in the treatment of central serous chorioretinopathy (CSCR) with subretinal fluid (SRF) in under-represented populations. We reviewed records of 25 eyes with CSCR and SRF that underwent focal laser photocoagulation. Visual acuity (VA) and central macular thickness (CMT) were recorded prior to laser, after laser treatment, and at final follow-up and were all compared using Wilcox signed-rank tests after using Shapiro-Wilk tests to determine normality. The racial and ethnic breakdown of our cohort (n = 25) includes 64% Hispanic (n = 16), 20% black (n = 5), 12% Asian (n = 3), 4% other (n = 1). Patients were followed for a median of 15.5 months (range: 5.75–87 months) after treatment. The VA prior to laser compared to best-available VA significantly improved (p = 0.0003). Pre-laser CMT to post-laser CMT (p < 0.0001) and pre-laser CMT to final CMT (p < 0.0001) significantly improved. Excluding the one eye that developed a choroidal neovascular membrane, the pre-laser VA to final VA improved significantly (p = 0.0047) as well as the pre-laser CMT to final CMT (p < 0.0001). Of the 25 eyes, 4 had persistent SRF following laser, and of the 21 eyes with complete resolution of SRF, 2 developed recurrent SRF. Focal laser photocoagulation can significantly improve VA and CMT in CSCR with active SRF in patients who have been under-represented in prior clinical studies.

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Introduction

Central serous chorioretinopathy is a common retinopathy that threatens vision and is characterized by serous detachments of the neurosensory retina and detachments and alterations of the retinal pigment epithelium (RPE). While its exact pathogenesis is unclear, it is theorized that a hyperpermeable choriocapillaris combined with localized malfunction of the RPE leads to the accumulation of serous fluid in the subretinal space (Fig. 1a) [1]. It is often self-limited, with resolution of fluid within 1–4 months [1–3]. However, about 50% of patients with an initial spontaneous fluid resolution will experience a recurrent episode by 1 year [1]. Therefore, while spontaneous fluid resolution occurs frequently, recurrence or persistence of fluid is common and may require intervention to optimize visual outcome [1].

Focal laser photocoagulation to areas of fluid leakage can expedite resolution of subretinal fluid (SRF), particularly in those with focal and discrete points of leakage. Focal laser was the primary treatment prior to the advent of photodynamic therapy (PDT) [1, 3], which is now the preferred treatment for central serous chorioretinopathy (CSCR). However, PDT may not be easily available at some practices, and a recent nationwide shortage of PDT lasers has made it less accessible. Additionally, PDT requires intravenous infusion of a photosensitizing agent that has the potential for systemic adverse effects, and its photosensitizing effects mandate sun avoidance for several days after therapy. Therefore, for many practices, focal laser remains a viable, and sometimes the only, treatment option for patients with CSCR.

Although it was previously believed that CSCR predominantly affected white patients, more recent studies have shown that the disease is under-diagnosed in black patients [4] While CSCR has been studied in white and some Asian populations, it has rarely been studied in Hispanic populations [5, 6]. Additionally, racial disparities in major eye diseases and in the utilization of eye care services have been well documented. Several ophthalmic diseases have been found to disproportionately affect racial and ethnic minorities and these disparities persist in treatment outcomes. Low enrollment of patients from racial and ethnic minority groups in clinical trials for eye diseases has been documented in the past, with most studies consisting of a majority of white research participants [7]. Furthermore, the majority of studies regarding treatment response in CSCR consist of white patients or patients with

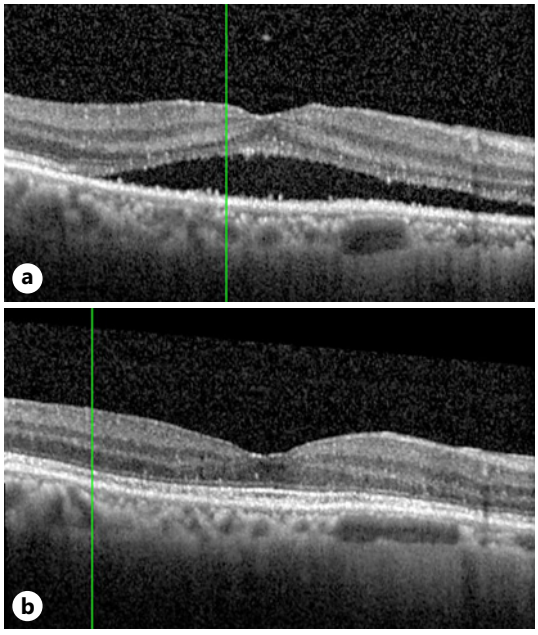

Fig. 1. a OCT in central serous retinopathy demonstrating the accumulation of chronic serous fluid in the subretinal space, including the presence of thickened photoreceptors, hyperreflective dot-like precipitates, and granular material. **b** Resolution of SRF after focal laser photocoagulation as seen on OCT.

unknown demographics [8–10]. It is in this context that our case series examines the effects of focal laser photocoagulation in a predominantly Hispanic and black population to determine its efficacy in cases of CSCR with active SRF in an urban, academic institution who serve under-represented populations.

Materials and Methods

Our databases were queried for patients 18 years of age and older with a diagnosis of CSCR from 2005 to 2018 and narrowed to those who received argon focal laser photocoagulation. Patients were included in this retrospective review if they demonstrated findings of subfoveal SRF on optical coherence tomography (OCT) [1], and focal and/or discrete extrafoveal points of leakage on fluorescein angiogram outside of the foveal avascular zone. Patients who had symptoms for less than 4 months were only included in this analysis if they showed evidence of chronic SRF on OCT, including hyper-reflective dot-like precipitates and granular material in the retina or subretinal space. Exclusion criteria included lack of sufficient follow-up, prior treatment for CSCR, and symptom duration of less than 4 months (n = 2) without signs of chronic SRF on OCT since these cases may have potentially resolved spontaneously. While including patients with evidence of fluid chronicity without a specified duration of symptoms is atypical, we used this criteria because under-represented patients often have symptoms for many months to years before seeking care, due to lack of medical coverage, transportation costs, and lack of caregiver or advocate, and often, by the time they seek care, they do not remember their symptom duration.

Patients received 532 nm argon laser treatment with a spot size of 50–200 μm and power titration to produce a minimally visible laser burn at the fluorescein angiogram-guided leakage site. Central macular thickness (CMT) was measured, using OCT, at baseline before treatment, at the time of the best-available visual acuity (VA) after treatment, and at the final follow-up visit.

Data regarding age, sex, race/ethnicity, symptoms, VA, CMT, laser specifications, additional interventions, and the period of observation were recorded from the medical records. Racial and ethnic identities of included patients were collected from electronic charts [11]. For patients who received multiple laser treatments, the symptom duration before the initial treatment was used to calculate the symptom duration. Outcomes measures included changes in VA and CMT, resolution or persistence of SRF, recurrence of SRF, and complications such as choroidal neovascular membrane (CNVM) formation. To determine the effects of laser therapy, we analyzed VA and CMT prior to laser intervention, after laser therapy, and at final follow-up. Since patients in the retina clinic did not receive a refraction, the best-available vision including pinhole vision, instead of best-corrected vision, was noted in the record.

Data was analyzed using Statistical Analysis Software (SAS version 9.4). The Shapiro-Wilk test was used to determine whether VA and CMT data were normally distributed. Wilcox signed-rank tests between paired VA and CMT data, averages, medians, and standard deviations were calculated. LogMAR conversions were used to analyze Snellen values. Final VA of counting fingers and sensing hand motions were recorded as logMAR 2 and 3 [11].

Results

The final sample size was 25 eyes from 24 patients. Of the 25 eyes, 15 eyes had unknown symptom duration and were included based on evidence of chronicity on OCT. Of the remaining 10 eyes, 3 eyes had symptom duration of less than 4 months (one with duration of 1 month, two with duration of 3 months) and were also included based on OCT findings. The

remaining 7 eyes had symptom duration of 4 months or greater (range: 4–60). The number of laser treatments for patients who received multiple laser treatments ranged from 1 to 3 treatments. Two eyes received multiple focal laser treatments for recurrent (n = 1) or persistent (n = 1) SRF. Patients were followed for a median of 15.5 months (range: 5.75–87 months) after treatment. Our patient population consisted of 22 males (88%) and 3 females (12%), of various racial and ethnic backgrounds (64% Hispanic [n = 16], 20% black [n = 5], 12% Asian [n = 3], 4% other [n = 1]) and a mean age of 47.34 ± 9.01 years.

Of the 25 eyes, 21 (84%) experienced complete resolution of SRF at a median of 1.75 months after laser treatment, while the remaining four had persistent fluid up to a median of 10 months after laser. Of these 21 eyes, 19 (90%, 76% of all eyes) remained free from recurrence until final follow-up (median 8 months [range: 1–87 months]). Two of 21 eyes (9.52%) with initial SRF resolution developed recurrent fluid between 2 months and 2 years after laser therapy. One was treated with eplerenone 50 mg daily and the other resolved spontaneously. Both recurrences were in Hispanic patients. Of the four eyes with persistent SRF, one received PDT, one subject of black race developed CNVM requiring anti-VEGF therapy (7 injections over 18 months) following laser, one received additional focal laser and PDT, and the fourth was lost to follow-up. It was unclear, based on record review, if the development of CNVM was secondary to the laser treatment or the CSCR disease itself. Of the four eyes with persistent SRF, two were of black race, one was of Hispanic ethnicity, and one was identified as "other."

At baseline, mean VA was 0.36 ± 0.30 logMAR (Snellen equivalent 20/46) with an average CMT of 384.12 ± 132.20 μm. The median period of symptom duration prior to laser was 4 months (range: 1–60 months). The average best-available VA after focal laser photocoagulation was 0.16 ± 0.25 logMAR (Snellen equivalent 20/29) with an average CMT of 248.64 ± 68.12 μm measured at the time of best-available VA. This best-available VA was noted at a median of 4.00 months (range: 1–23 months) after laser treatment.

The average CMT and VA at final follow-up were calculated for all 25 eyes. The mean VA at patients' final follow-up was 0.28 ± 0.48 logMAR (Snellen equivalent 20/38) with a mean CMT of 245.75 ± 63.15 μm; final follow-up occurred at a median of 8 months (range: 1–87 months) after laser. The final mean VA, excluding the eye that developed CNVM post-laser, was 0.20 ± 0.33 logMAR (Snellen equivalent 20/28) with a mean CMT of 235.83 ± 41.21 μm occurring at a median of 7.00 months after laser (Table 1).

We discovered a statistically significant improvement in VA when comparing the average best-available VA after focal laser photocoagulation to VA prior to laser (p = 0.0003) (Fig. 2), an improvement in CMT when comparing the thickness at the time of best-available VA after laser to thickness prior to laser (p < 0.0001) (Fig. 3), and an improvement in CMT when comparing CMT at final follow-up after laser to CMT prior to laser (p < 0.0001). We did not discover a statistically significant improvement in VA at final follow-up compared to pre-laser VA with all patients (p = 0.0556). However, when the eye that developed the CNVM was excluded from the analysis, the improvement of final VA and final CMT was statistically significant (p = 0.0047 and p < 0.0001, respectively).

Discussion

CSCR is often a self-limited process [1, 12, 13]. Prior investigation demonstrates spontaneous resolution of acute SRF associated with initial observation in 80–90% of patients [2]. However, in cases of persistent SRF, RPE atrophy can lead to progressive and permanent visual dysfunction [3, 13]. Focal laser photocoagulation is one option for treatment used to hasten fluid reabsorption in CSCR [1, 3]. It is hypothesized that photocoagulation improves the

Table 1. Visual acuity (VA) and central macular thickness (CMT) at various time points surrounding focal laser photocoagulation administered for the treatment of CSCR with acute SRF

Time point	*n*	Average VA (logMAR)	Snellen equivalent	Median follow-up, months	Average CMT, μm
Pre-laser	25	0.36±0.30	20/46	4.00 (Symptom duration prior to laser)	384.12±132.20
Post-laser best vision	25	0.16±0.25	20/29	4.00	248.64±68.12
Final follow-up post-laser	25	0.28±0.48	20/38	8.00	245.75±63.15
Final follow-up post-laser excluding patients with CNVM (*n* = 1)	24	0.20±0.33	20/28	7.00	235.83±41.21

Since patients in the retina clinic did not receive a refraction, the best-available vision including pinhole vision, instead of best-corrected vision, was noted from the record.

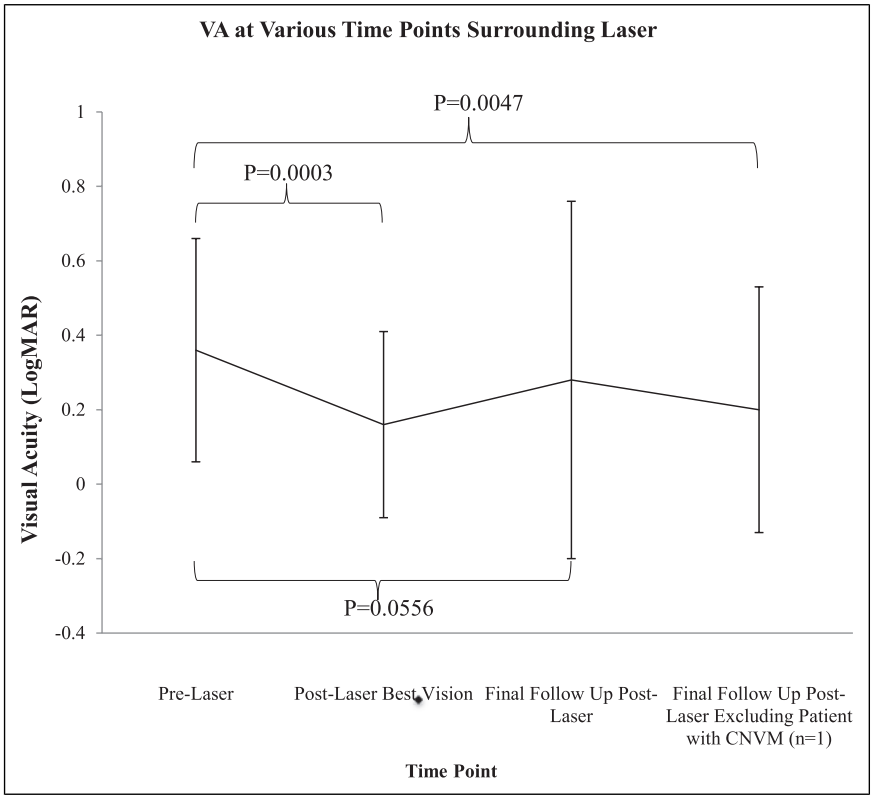

Fig. 2. Changes in visual acuity after focal laser photocoagulation to treat SRF seen in CSCR. Vision significantly improved after laser when comparing vision pretreatment to best-available vision posttreatment and to vision at final follow-up, excluding the patient that developed a choroidal neovascular membrane (CNVM). These results demonstrate that the use of focal laser photocoagulation in patients of Hispanic background is a viable option to treat CSCR; however, it is limited by formation of a CNVM.

integrity of the RPE by promoting recruitment of healthy RPE cells and improving the function of ion pumps [1, 3]. In studies comparing laser photocoagulation to observation or sham lasers, patients receiving laser therapy demonstrated faster time to resolution of SRF, although laser treatment seems less effective in achieving an improvement in VA or reducing the rate of new

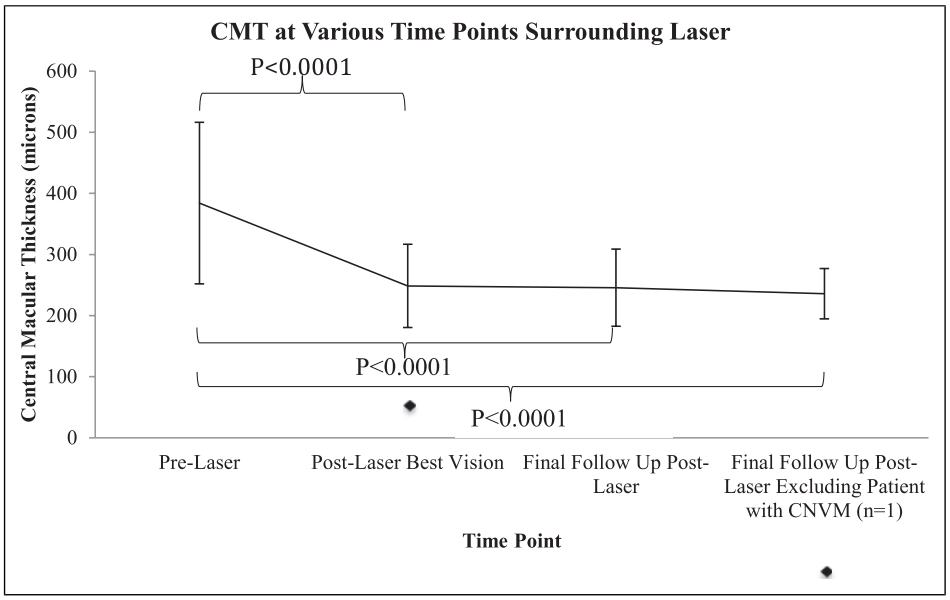

Fig. 3. CMT, measured by OCT, surrounding the implementation of focal laser photocoagulation. CMT significantly decreased after focal laser photocoagulation at the time of best vision posttreatment and at the patient's final follow-up, representing a decrease in SRF.

episodes compared to treatment with PDT [3, 14]. Most previous articles, however, do not report demographic breakdowns of subjects undergoing laser therapy [8–10].

Our cases are unique from the aforementioned studies in that we found favorable outcomes with focal laser treatment in under-represented populations. We found that best-available VA and CMT significantly improved after focal laser photocoagulation, along with final VA, with the exception of one eye that developed CNVM. Additionally, 76% (n = 19) of treated patients had complete fluid resolution without recurrence after laser therapy such as the patient whose post-laser treatment OCT is shown in Figure 1b (and pre-laser treatment OCT is shown in Fig. 1a). Similar rates of complete fluid resolution without recurrence after laser therapy have been reported in literature that does not specify the demographic breakdown. For example, Ficker et al. [8] report 78% and Müller et al. [9] report 75%.

While focal laser is a treatment to be considered, it can result in scotomas and pose a risk of secondary CNVM [3]. In our case series, 1 of 25 (4%) treated patients developed CNVM. While the exact frequency of laser associated-CNVM in CSCR is unknown, it has been suggested to occur in under 10% of treated patients [3]. In a retrospective case series, 52 of 217 (24%) eyes with chronic CSCR, defined as the presence of SRF of greater than 6 months, developed CNVM as a complication of the disease itself rather than intervention [15].

Limitations of this case series include its retrospective nature, including variations in the time of follow-up, variable length of chronicity of SRF, and variable laser parameters based on physician preference. In addition, our relatively small sample size may limit statistical power.

Conclusions

Our case series demonstrates that focal laser photocoagulation is still a potential treatment option for CSCR in patients who have traditionally been under-represented in prior clinical studies.

Statement of Ethics

This study protocol was reviewed and approved by the Institutional Review Board of Boston Medical Center (BMC) and Boston University Medical Campus, approval number H-37569. The Institutional Review Board of Boston Medical Center and Boston University Medical Center did not require written permission from the patients included in this study. This report does not contain any personal information that could lead to the identification of the patients.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Kajal Sangal was involved in conceptualization, acquisition of data, analysis, drafting, and editing the manuscript. Minali Prasad was involved in analysis, drafting, and editing the manuscript. Nicole H. Siegel, Xuejing Chen, and Steven Ness were involved in acquisition of data, editing, and final approval of manuscript. Manju L. Subramanian was involved in conceptualization, acquisition of data, editing, and final approval of the manuscript.

Data Availability Statement

The data that support the findings of this study are not publicly available due to their containing information that could compromise the privacy of research participants but are available from the corresponding author Manju L. Subramanian.

References

1 Nicholson B, Noble J, Forooghian F, Meyerle C. Central serous chorioretinopathy: update on pathophysiology and treatment. Surv Ophthalmol. 2013 Mar;58(2):103–26.
2 Burumcek E, Mudun A, Karacorlu S, Arslan MO. Laser photocoagulation for persistent central serous retinopathy. Ophthalmology. 1997 Apr;104(4):616–22.
3 Iacono P, Battaglia Parodi M, Falcomatà B, Bandello F. Central serous chorioretinopathy treatments: a mini review. Ophthalmic Res. 2015 Dec 1;55(2):76–83.
4 Desai UR, Alhalel AA, Campen TJ, Schiffman RM, Edwards PA, Jacobsen GR. Central serous chorioretinopathy in African Americans. J Natl Med Assoc. 2003 Jul 1 [cited 2022 Jan 19];95(7):553–9. Available from: https://pmc/articles/PMC2594640/?report=abstract.
5 Kumawat D, Ravi AK, Sahay P, Alam T, Desai A, Kumar A. Systemic evaluation of patients with central serous chorioretinopathy: a case-control study. Eur J Ophthalmol. 2021 Nov 25;31(6):3223–30.
6 Li Y, You QS, Wei WB, Xu J, Chen CX, Wang YX, et al. Prevalence and associations of central serous chorioretinopathy in elderly Chinese. The Beijing Eye Study 2011. Acta Ophthalmol. 2016 Jun 1 [cited 2022 Jul 21];94(4):386–90. Available from: https://pubmed-ncbi-nlm-nih-gov.ezproxy.bu.edu/26928876/.
7 Hamid M, Orlov S, De Lott L, Ling JJ, Woodward MA. Reporting and enrollment of women and racial minorities in ophthalmic clinical trials. Invest Ophthalmol Vis Sci. 2019 Jul 22;60(9):5469.

8 Ficker L, Vafidis G, While A, Leaver P. Long-term follow-up of a prospective trial of argon laser photocoagulation in the treatment of central serous retinopathy. Br J Ophthalmol. 1988 [cited 2022 Jan 19];72(11):829–34. Available from: https://pubmed.ncbi.nlm.nih.gov/3061449/.
9 Müller B, Tatsios J, Klonner J, Pilger D, Joussen AM. Navigated laser photocoagulation in patients with nonresolving and chronic central serous chorioretinopathy. Graefes Arch Clin Exp Ophthalmol. 2018 Sep 1 [cited 2022 Jul 6];256(9):1581–8. Graefe's archive for clinical and experimental ophthalmology = Albrecht von Graefes Archiv fur klinische und experimentelle Ophthalmologie. https://pubmed-ncbi-nlm-nih-gov.ezproxy.bu.edu/29876733/.
10 Ambiya V, Khodani M, Goud A, Narayanan R, Tyagi M, Rani PK, et al. Early focal laser photocoagulation in acute central serous chorioretinopathy: a prospective, randomized study. Ophthalmic Surg Lasers Imaging Retina. 2017 Jul;48(7):564–71.
11 Holladay JT. Visual acuity measurements. J Cataract Refract Surg. 2004 Feb;30(2):287–90.
12 Klein ML, van Buskirk EM, Friedman E, Gragoudas E, Chandra S. Experience with nontreatment of central serous choroidopathy. Arch Ophthalmol. 1974 Apr 1;91(4):247–50.
13 Hanumunthadu D, Tan AS, Singh S, Sahu N, Chhablani J. Management of chronic central serous chorioretinopathy. Indian J Ophthalmol. 2018;66(12):1704.
14 Park YJ, Kim YK, Park KH, Woo SJ. Long-term efficacy and safety of photodynamic therapy in patients with chronic central serous chorioretinopathy. Ophthalmic Surg Lasers Imaging Retina. 2019 Dec 1 [cited 2022 Jul 21];50(12):760–70. Available from: https://pubmed-ncbi-nlm-nih-gov.ezproxy.bu.edu/31877221/.
15 Mrejen S, Balaratnasingam C, Kaden TR, Bottini A, Dansingani K, Bhavsar KV, et al. Long-term visual outcomes and causes of vision loss in chronic central serous chorioretinopathy. Ophthalmology. 2019 Apr 1;126(4):576–88.