Subthreshold Diode Micropulse Laser Vs. Observation in Acute Central Serous Chorioretinopathy

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Idiopathic central serous chorioretinopathy (CSC) is a disease of neurosensory retinal detachment at the posterior pole caused by leakage from decompensated retinal pigment epithelium (RPE).

CSC may be acute, recurrent or chronic. Acute CSC causes an acute localized detachment of the retina with mild to moderate loss of visual acuity associated with one or a few focal leaks seen during Fundus Fluorescein Angiography (FFA). Typically, CSC resolves spontaneously within 3 months in more than 50% of patients, with recovery of visual acuity (VA) despite some pigment epithelium scarring which may manifest as diminished contrast sensitivity. Chronic CSC has widespread alteration of pigmentation of the RPE related to long-term presence of sub-retinal fluid (SRF) for more than 6 months. Optical Coherence Tomography (OCT) examination often reveals associated with subretinal accumulation of fibrin, lipids, choriocapillaris atrophy, and occasionally choroidal neovascularization.

The focal areas of leakage through the RPE that are characteristic of classic CSC were one of the first clues to the pathogenesis of the disease. These pinpoint leaks were seen as focal defects in the RPE that were thought to be primarily responsible for the accumulation of sub-retinal fluid. There is widespread loss of RPE cells seen on clinical exam and Fundus Auto-fluorescence in patients with Diffuse Retinal Pigment Epitheliopathy, and the loss of RPE barrier and pumping functions in the setting of an engorged choroid, results in chronic sub-retinal fluid. Most investigators now believe that the primary pathology occurs in the choriocapillaris and there is hyperpermeable choroid.

Acute CSCR is typically a self-limited process. As mentioned earlier,
resolution of sub-retinal fluid along with recovery of visual acuity is observed to usually occur within 3 months. Recurrences are common, however, occurring in approximately 30-50% of patients by one year.\textsuperscript{1} Observation has been the standard initial management in CSC in the past. But the contrast sensitivity and night vision may be permanently impaired in CSC affecting overall quality of vision. This residual contrast sensitivity impairment is explained by fluid accumulation under the retina in the acute stage of the disease, which causes a certain amount of damage to the photoreceptors. This damage persists even after the fluid is reabsorbed.\textsuperscript{2,7} Treatment at the acute stage of the disease targets faster visual rehabilitation, restored quality of vision by prompt resolution of the neurosensory detachment (NSD) and reduced recurrences. Various factors that influence the visual outcome after treatment are duration of symptoms, presence of Pigment Epithelial Detachment or focal leak, size of sub-retinal fluid or Pigment Epithelial Detachment, baseline confluent RPE atrophy, development or progression of RPE atrophy in the irradiated area and development of foveal atrophy. Prolonged duration of symptoms, foveal IS-OS junction integrity not maintained after resolution, confluent areas of RPE atrophy were all associated with poor visual prognosis. The presence of Pigment Epithelial Detachment, though not directly associated with visual prognosis, increases the risk of foveal atrophy. There is frequent development of RPE atrophy after resolution of Pigment Epithelial Detachment.

Aims and Objective of this study are:

- To study the effect of Subthreshold Micropulse Diode (SMD) Laser on Acute CSC (< 1 month duration) and compare it with observation alone in terms of:
  
  a) Resorption of fluid
  
  b) Qualitative (metamorphopsia and contrast sensitivity) and Quantitative improvement of visual acuity,

- Recurrence, if any, during the follow up period.

- To study the complications and side effects, if any, associated with the procedure.

**MATERIALS AND METHODS**

The study was conducted at Guru Nanak Eye Centre, New Delhi between 01/08/2013 to 01/04/2015. It was a prospective, randomized, controlled, interventional, comparative study. The study consisted of 36 patients diagnosed with acute CSC with symptoms of less than 1 month duration. The randomization was done using randomized computer generated
system. Two groups were formed with 18 patients in each group. Group 1 included 18 patients who were treated with SMD Laser Photocoagulation. Group 2 included 18 patients who were observed for the period of follow up. Written informed consent, clearly explaining all potential risks and benefits of each treatment option i.e. SDM Laser Photocoagulation and observation, was discussed with and obtained from every patient.

### RESULTS

The mean visual acuity (in logMAR) at baseline was 0.53 ± 0.3 for Group A, i.e. the Laser group. The mean visual acuity at baseline for Group B, the observation group, was 0.51 ± 0.27. The p-value was significant for improvement in visual acuity in both the groups at 2 weeks, 4 weeks and 4 months.

Between the two groups, Group A had a significantly greater improvement at 2 weeks, (p value = 0.018)

In both group A and group B contrast sensitivity at all spatial gratings improved at 2 weeks (p=0.026 for Laser, p=0.008 for observation), 4 weeks (p=0.015 for Laser, p=0.004 for observation) and 4 months (p=0.004 for Laser, p<0.01 for observation). This improvement was statistically significant. Between groups, improvement in Group A appears to be better at 2 weeks and 4 weeks in spatial gratings FACT-A, FACT-B, FACT-C, FACT-D, FACT-E as per the slope of the graph; although this improvement was not statistically significant.

At baseline, all 16 of the patients from Group A (laser group) could see a scotoma on viewing the amsler grid chart and 14 out of 16 patients from Group B (observation group) could see a scotoma. This improved at 2 weeks.
10 having resolved, with no scotoma in Group A and 6 in group B. at 4 weeks, all 16 in the Laser group, Group A had resolved and 12 in Group B. At the end of the follow up period, 4 months, 16 from Group A maintained this and 15 from Group B did not have any scotomas.

The mean value for Photoostress test (PST), at baseline, for group A and B was 49.69 seconds and 39.25 seconds respectively. There was significant improvement in both the groups at the end of follow-up.

At baseline, all 16 patients in Group A and all 16 in Group B had an identifiable leak on FFA. At 4 weeks, 13 (81.25%) patients in Group A had no leak and 10 (62.5%) in Group B had no leak. 1 patient in Group B had a resolving leak. At 4 months, 1 patient in each group had persistent leak.

All 16 patients in both groups had a neurosensory detachment at baseline. At 2 weeks, 5 patients in Group A had persistent NSD (31.25%), and 3 (18.75%) had completely resolved NSD. The rest of the 8 (50%) had a reduced NSD. In Group B 6 had persistent NSD (37.5%), 10 (62.5%) had reduced NSD but none had completely resolved NSD. At 4 weeks, only 2 (12.5%) had persistent NSD, 4 (25%) had reduced NSD and 10 (62.5%) had completely resolved NSD in Group A, while 6 (37.5%) had persistent NSD in Group B. 6 patients each had persistent and deduced NSD while 4 had completely resolved NSD in group B. At 4 months, 1 in each Group had NSD, though they were reduced from before.

The mean Central Macular Thickness (CMT), measured on Optical Coherence Tomography, at baseline was 438.75 µm in Group A and 500.38 µm in Group B. The improvement in Central Macular Thickness from baseline to 2 weeks (p= 0.004 for Laser, p=<0.01 for observation), 4 weeks (p<0.01 for Laser, p<= <0.01 for observation), and 4 months (p<0.01 for Laser, p=<0.01 for observation) was statistically significant in both the groups. Between the two groups, there was statistically significant improvement in Group A (Laser Group) as compared to Group B (observation group) at 2 weeks (p= 0.002)

The Mean deviation (MD) and Pattern Standard deviation (PSD) for 10-2 Visual Field examination, at baseline, for Group A was -6.56 and 3.15. The Mean deviation and Pattern standard deviation for 10-2 Visual Field examination, at baseline, for group 2 was -9.87 and 2.64. There was significant improvement from baseline to 4 months in both the groups.

Complications and recurrences

There were no complications seen associated with Sub-threshold diode Micropulse laser Photocoagulation, in the study. Group A had a patient with recurrent and Group B had a patient with persistent leak on FFA and NSD as recorded on SD-OCT at 4 months.
DISCUSSION
We have compared the standard of care *i.e.*, observation Vs. SMD laser for acute CSCR. Both groups in our study showed statistically significant improvement in visual acuity over the follow up period. However, the laser treated group showed better and faster improvement than the observation group, especially at the first follow up visit at 2 weeks.

Faster resolution of the NSD with matching improvement in BCVA and contrast sensitivity with no detectable functional and anatomical damage as observed on FFA, SD-OCT, 10-2 visual fields was noted in the laser group.

Both groups had 1 case of persistent NSD at the end of 4 months. It is difficult to say that whether laser photocoagulation has any role in reducing the recurrence of disease and further studies are warranted to assess the pathogenesis and cause of recurrent disease.

No complications or adverse events were noted with laser in a follow up of 4 months. Longer follow-up is required to assess the long-term effects associated with the complications of the procedure.

The drawbacks of SMD laser include the absence of a visible end point which makes it technically challenging.

There is a demand for a treatment modality for acute CSCR that can aid in faster recovery without or with minimal collateral damage in terms of anatomical and functional outcomes.

SMD laser though has been tested in a limited number of patients and with a relatively smaller follow-up period, provided a viable alternative to observation for the treatment of acute CSCR with safety.

CONCLUSION
Sub-threshold Micropulse Diode laser as a safe and effective alternative to observation in acute CSCR especially for patients in whom lifestyle demands require fast rehabilitation with minimum disruption of productive workdays. A larger study with a longer follow up period is required to better assess the long-term effects of SMD laser versus observation for acute CSC.

REFERENCES

