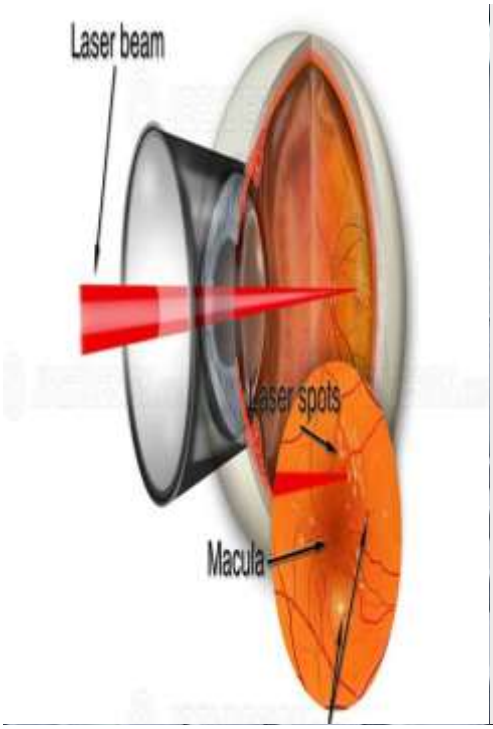

Micro-pulse Laser for CSCR

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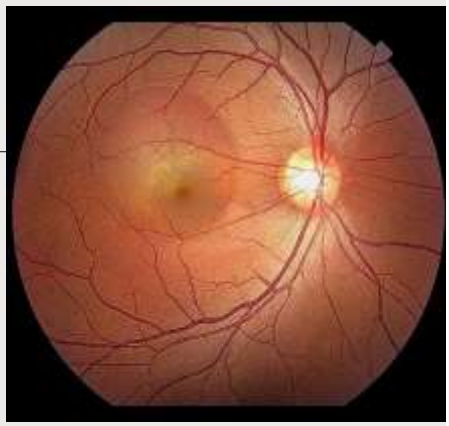
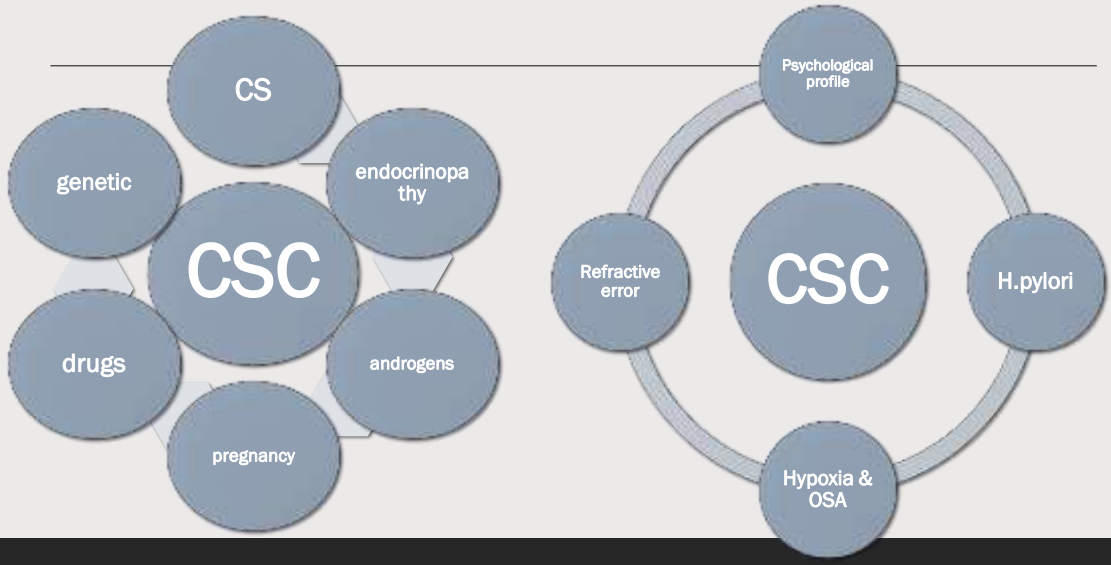
Central serous chorioretinopathy (CSC or CSCR) is a chorio-retinal disease that causes idiopathic serous retinal detachment with or without pigment epithelial detachment (PED) most commonly seen in the macular region

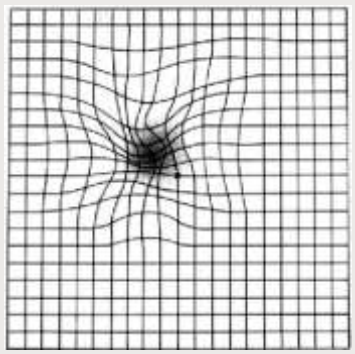


Etiopathogenesis



Clinical picture
Sypmtoms:

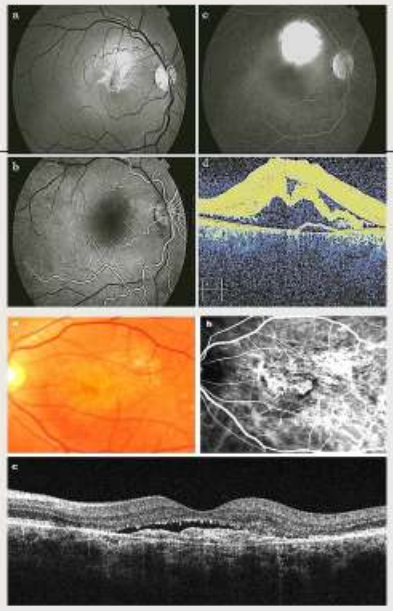
- unilateral blurred vision
- relative central scotoma
- metamorphopsia.
- micropsia
- moderate dischromatopsia (abnormal color perception)
- reduced contrast sensitivity.
- However, CSCR may be asymptomatic



Complications

1-Fibrin deposition

2-Choroidal neovascularization



Investigations

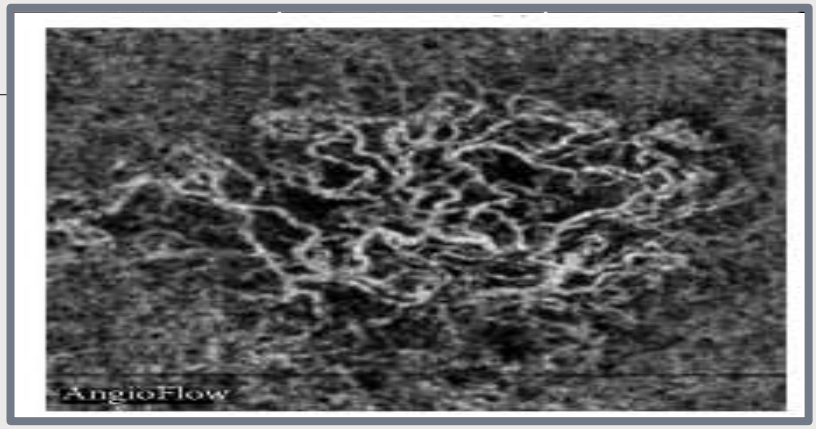
Ocular coherence tomography (OCT)

Fundus autofluorescence (FAF)

Fundus Fluorescein Angiography (FFA)

Indocyanine Green Angiography (ICGA)

Optical Coherence Tomography Angiography (OCT-A)



Management

Regardless the type of CSCR, risk factors must be eliminated as a preliminary step

Treatment of acute CSCR:

- **Observation** with patient reassurance is the main line of treatment.
- **Temporary Plus convex lenses** can be used to reverse the acquired hyperopia induced by central detachment

Treatment of chronic CSC:

1- Photodynamic therapy (PDT)

2- Subthreshold micro-pulse laser (MPL)

3- Laser photocoagulation

4-Transpupillary thermotherapy (TTT)

5- Intravitreal injection of anti-vascular endothelial growth factor (anti-VEGF)

6- Antagonists of mineralocorticoid receptors (MR) and glucocorticoid receptors

Focal laser photocoagulation

Focal laser photocoagulation to seal the leaking points,as identified on FFA, **more than 500 µm from the center of the fovea** :

(1) persistence of a serous retinal detachment for more than 4 months

(2) recurrence in an eye with visual deficit from previous CSCR

(3) visual deficits in opposite eye from previous episodes of CSCR

(4) occupational or other patient need requiring prompt recovery of vision.

Focal laser photocoagulation

- one to three low-to-moderate intensity burns to the leakage site in an attempt to produce a mild whitening.
- can effectively promote the resolution of the fluid but, unfortunately, has no clear effects on the visual acuity improvement and on the recurrence rate over the follow-up.
- Conventional laser application for CSCR can bring about some complications, including CNV development, atrophic changes with paracentral scotoma and enlargement of the laser scar over the follow-up.

PDT

the treatment of choice in chronic CSCR

low-fluence PDT / Half dose PDT (3 mg/m^2 verteporfin)

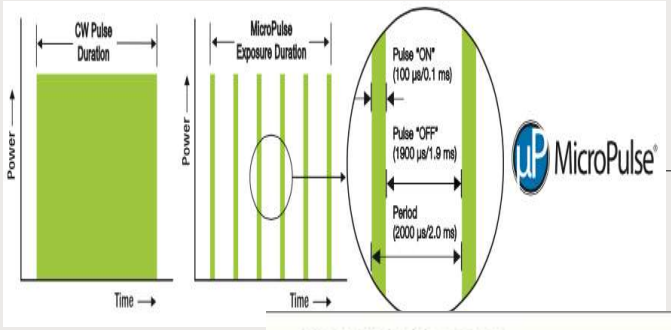
MICROPULSE LASER

Mechanism

- Act on the activity of the RPE by promoting the migration and proliferation of new cells,
- Thermal stimulation of the RPE to lead to a regulation of growth factors, including permeability factors, and to the activation of heat shock proteins (HSP) promoting the pumping function of RPE cells.
- Upon the resumption of RPE activity, a progressive but slow reabsorption of the subretinal fluid would occur
- Additional advantages of MPL would include the ability to apply the laser near or over the fovea, as well as the option to treat the same area in multiple sessions.

Principles

- In continuous wave mode, the laser energy is delivered as a single pulse, with a "width" typically in the range of 0.1-0.5 sec that constitutes the exposure duration.
- In micropulse mode, the laser energy is chopped into a train of repetitive short pulses (typically 100-300 μsec in duration each) within an "envelope" whose width is typically in the range of 0.1-0.5 sec, and this envelope duration constitutes the exposure duration.
- The "ON" time is the duration of each micropulse. The "OFF" time between successive micropulses reduces heat in the tissues and regulates the thermal isolation of each pulse contribution.



MICROPULSE LASER

Repetitive short pulses permit tissue to cool between pulses and reduce thermal buildup.

DUTY CYCLE

Percentage of time that the laser is on

ON TIME: Duration of each micropulse
OFF TIME: Interval between micropulse

Period (T) = ON + OFF TIME

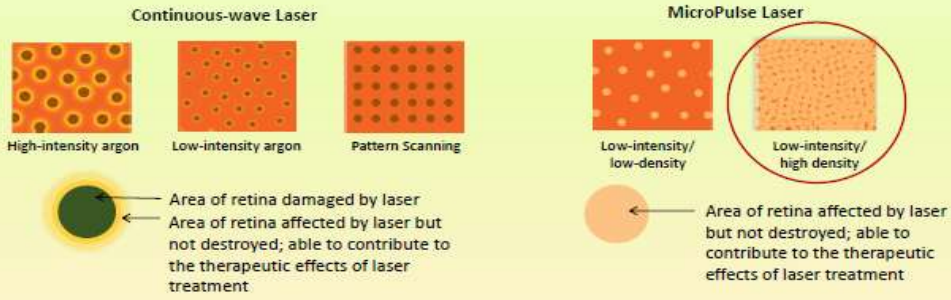
DUTY CYCLE(%)
= ON TIME/ T x 100

- the healing response of the RPE to thermal injury suggests that the useful therapeutic cellular cascade is activated, not by laser-killed RPE cells, but by the still-viable RPE cells surrounding the burned areas that are reached by the heat diffusion at sublethal thermal elevation.

- Unlike with CW photocoagulation, where the size of the final burn is always bigger than the laser spot on the retina, with MPL treatment the treated RPE area remains basically the size of the laser spot. The smaller RPE treated area may be responsible for the slower response, suggesting that a denser application of spots (**High Density**) should be used with MPL treatment

MicroPulse Low Intensity/High Density Application

Low-intensity MicroPulse exposures avoid thermal retinal injury. Therefore, **high-density** (confluent) coverage of the diseased retina is needed to maximize clinical effectiveness



DIFFERENT LASERS AVAILABLE WITH MICROPULSE MODE

810-nm Diode Laser:

- deep penetration into the choroid, but not clear if this is relevant in micropulse treatment

- a possible benefit especially for CSC since the choroid may play a role in the Pathogenesis of CSC.

- A potential disadvantage is a possible sensation of pain

577-nm Yellow Laser:

- advantage that xanthophyll, the pigment which is located in the inner and outer plexiform layers of the macula, absorbs the yellow light only minimally so treatment near the fovea is relatively safe.

How to determine Micropulse laser power

- Main challenge at present is fine-tuning the treatment dosimetry
- Settings are evolving
- 1st time do a TEST SPOT BURN FIRST
- Use conventional laser to get a power setting for gentle burn (duration 0.1s)
- Switch
  - 200um spot size
  - Duration to 200ms
  - 5% duty cycle
  - increase laser power by x 2-4

Fixed settings

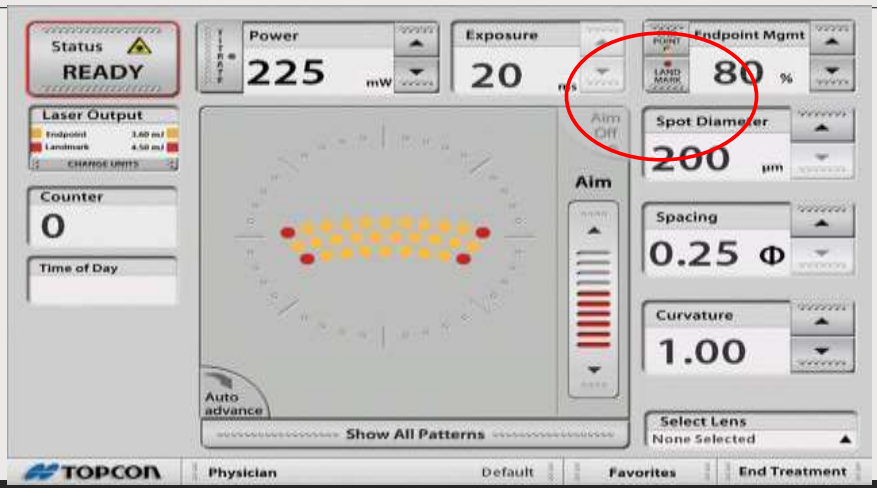
MicroPulse Laser settings

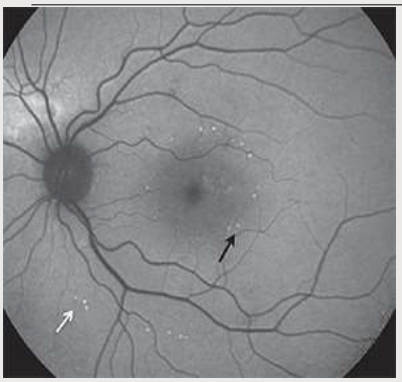
Micropulse laser is of low intensity
So to get a clinical response – need a confluent high density laser

- 200um spot size
- 200ms duration
- 400mW
- 5% duty cycle
- 7x7 confluent grid

the PASCAL Endpoint Management (EpM)

- Yellow 577nm laser
- titration of the laser power to a minimally visible retinal burn. This pulse energy is assigned the 100 % level on the EpM settings. The laser power and pulse duration are paired so that treatment is usually performed at a 30% energy level compared with the initial visible burn, a level established as the highest non-damaging setting in animal studies
- During treatment, the programmed application of 100 percent energy burns at the corner spots maintains orientation of the treatment pattern so that landmarks are visible





- Fundus autofluorescence (FAF) after photothermal stimulation with landmarks (100 percent energy), which appear as spots with increased FAF (black arrows).
- Titration points are also visible in FAF outside the arcades (white arrows). The 30 percent treatment spots were not visible clinically by FAF.

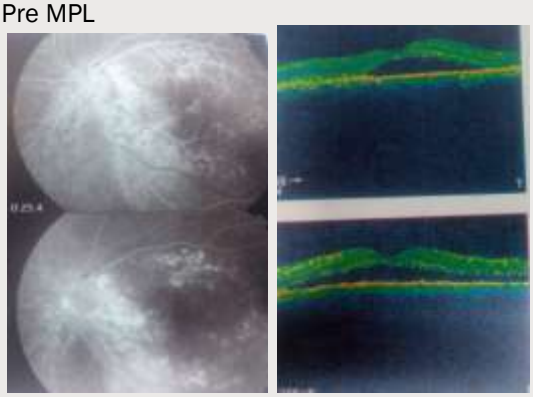
PLACE trial

- multicenter, randomized controlled clinical trial (2018)
- half-dose PDT versus high-density subthreshold MPL (810 diode)
- The primary end point was the complete disappearance of SRF at the first evaluation visit at 6 to 8 weeks after treatment. As a secondary outcome measure, the anatomic result at the final evaluation visit at 7 to 8 months after treatment and change in BCVA
- Half-dose PDT is superior to HSML for treating cCSC, leading to a significantly higher proportion of patients with complete resolution of SRF and functional improvement.
- may be attributed to the fact that PDT targets the choroidal tissue, which seems to be the tissue primarily affected in CSCR.
- criticized, especially for the laser delivery methodology. In particular, STLT was not appropriately administered in the PLACE trial, making it a kind of “homeopathic” therapy rather than a real laser application

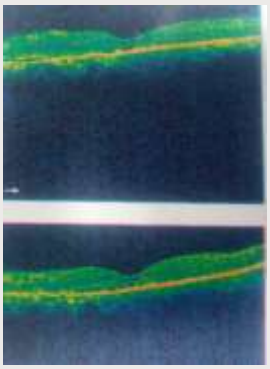
CSCR case 1

NO MUCH VISUAL IMPROVEMENT

Pre MPL

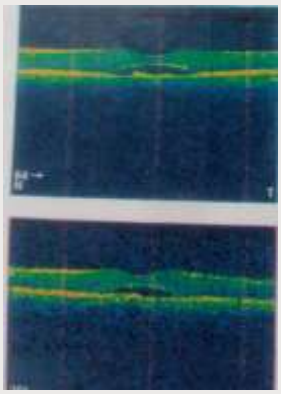


Post MPL



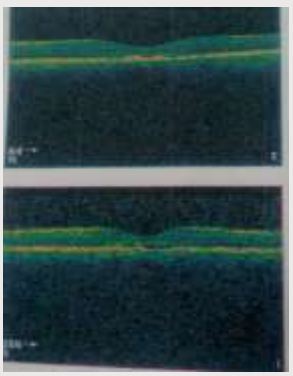
CSCR case 2

Pre MPL

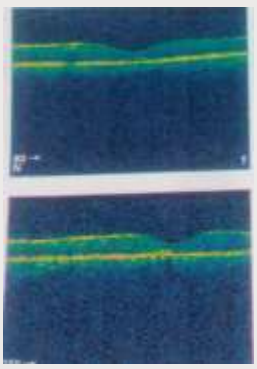


Post MPL

1 WEAK



1 MONTH



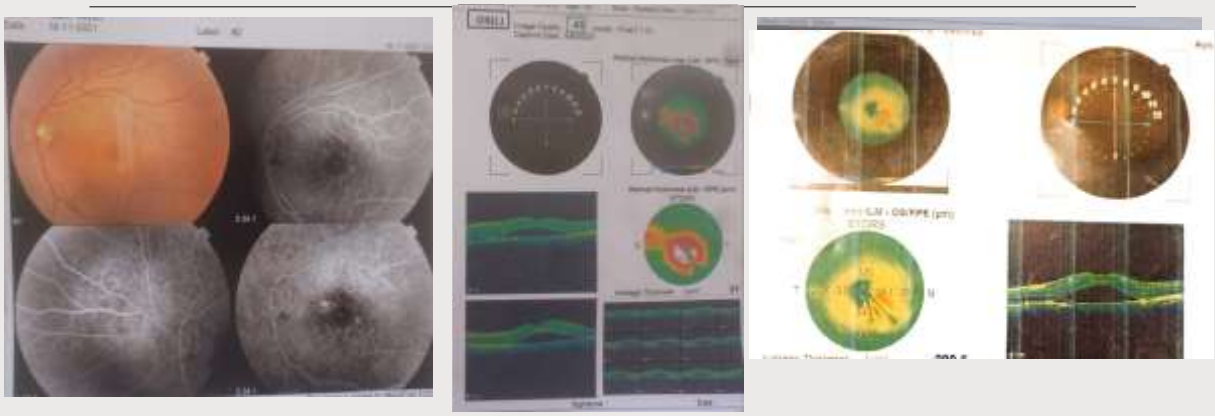
Chronic CSCR case 3

11/2021

Remissions and exacerbations

BCVA: 0.7

BCVA: 0.3



CLINICAL TIPS

- No visible tissue change during or at any time post MicroPulse
- Low intensity/ high density. Think of hundreds of spots not tens.
- life-size magnification lenses (Mainster Standard lens, 1.04x; and Area Centralis, 1.02x)
- There may be a tendency to undertreat at first
- Have patience. Response is usually slower (~ 3 months), may require re-treatment.
- It can be safely repeated.
- Be aware of different pigmentation. For a lightly pigmented patient, or one with a dense cataract, use 400 mW. If you have a more darkly pigmented patient, start at 280 to 320 mW.

TAKE HOME MESSAGE

- Noninvasive, highly safe, underutilized tool for several macular diseases.
- Increasing high-quality scientific evidence of safety and efficacy.
- Be patient as you gain clinical experience.

Thank you