

المؤتمر السنوي الدولي للجمعية المصرية
INTERNATIONAL CONGRESS OF THE

EGYPTIAN OPHTHALMOLOGICAL SOCIETY

EOS 2023



Laser in Retinal Vein Occlusion

(RVO)

by

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- **Points to be covered**

- **Role of laser treatment in RVO.**
- When to do laser treatment in RVO.
- Parameters of laser treatment.
- Complications of laser treatment.
- Results of recent clinical studies.
- Other modalities in laser therapy for RVO.
- Take Home Message.

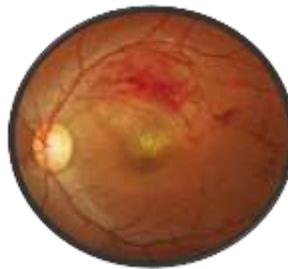


- **Role of laser treatment in RVO.**

- Drop of Visual Acuity (VA) in RVO is due **retinal ischemia** and **Macular Edema (ME)**.
- Treatment strategies aim to decrease **ME** by intravitreal Anti-VEGFs and retinal **ischemia** by laser treatment.



CRVO



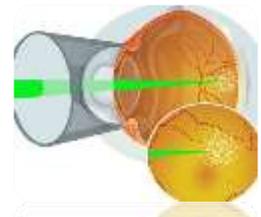
BRVO

<https://emedicine.medscape.com/article/798583-overview>



- **Role of laser treatment in RVO.**

- Laser photocoagulation uses a thermal energy to seal off leaking blood vessels and prevent new vascularization that lead to loss of vision.
- The main principle is to destroy the photoreceptors of hypoxic retina, increasing oxygen supply to undamaged sites and reducing capillary permeability, so as to reduce *VEGF* concentration and new vessels .

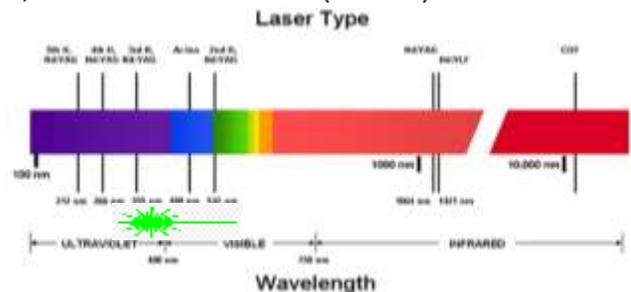


<https://www.aao.org/education/munnerlyn-laser-surgery-center/history-of-retinal-photocoagulation-pdt>

• Role of laser treatment in RVO.



- **Green** lasers (514 nm *argon* and 532 nm *Nd:YAG*) are absorbed well by melanin and hemoglobin, **yellow** (570 nm) is similar but may have less xanthophyll absorption. **Red** (647 nm) and infrared lasers may penetrate dense cataracts and hazy media better but may spread more deeply into the choroid causing more pain. So, In clinical practice, **green** laser is widely used to treat RVO, and **diode laser** (810 nm) is used for Cyclophotocoagulation.

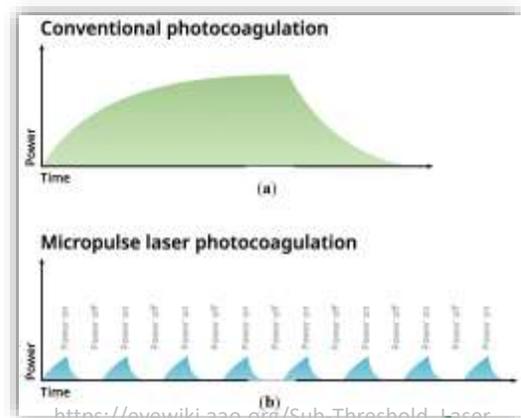


<https://www.aao.org/education/munnerlyn-laser-surgery-center/history-of-retinal-photocoagulation-pdt>

• Role of laser treatment in RVO.

- **Micropulse** (810-nm) laser with short bursts of energy (0.1 ms) may aid to treat macular edema secondary to BRVO. But, it is still need more clinical trials in comparison to conventional treatment.

- Also, **nd:YAG** (1064-nm) laser thrombolysis is still under clinical trials.



https://eyewiki.aao.org/Sub_Threshold_Laser

- Points to be covered

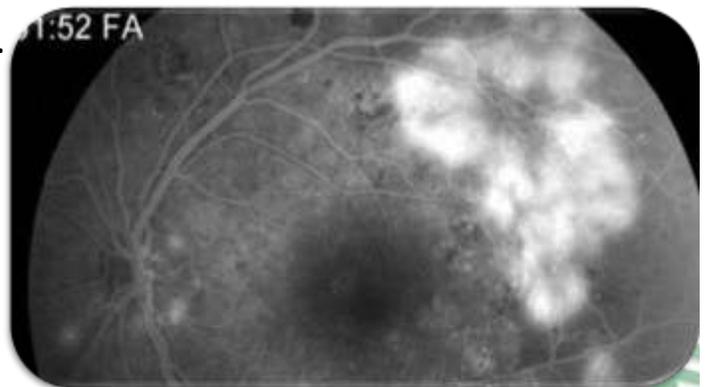
- Role of laser treatment in RVO.
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- Take Home Message.



- **When to do laser in RVO**

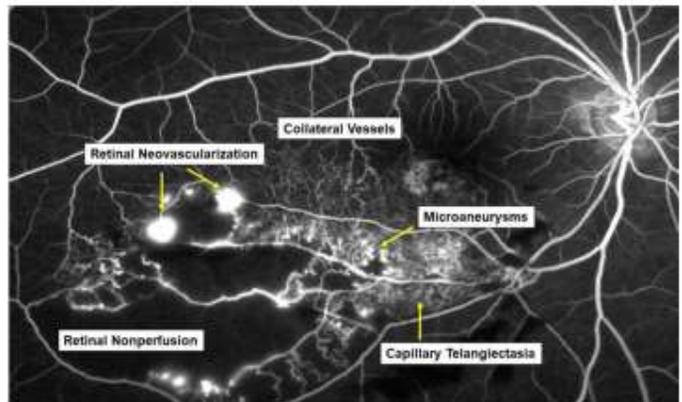
- Generally, panretinal or sectoral photocoagulation **should not** be applied unless patients develop neovascularization (retinal, optic nerve, or iris)

Confirmed by FFA & gonioscopy. 1:52 FA



• When to do laser in RVO

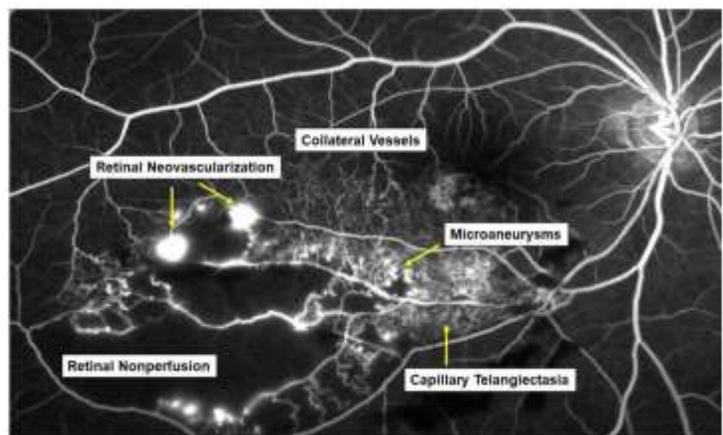
- Ischemia occurs more commonly in central retinal vein occlusions (CRVOs), but occurs in 40% with BRVOs who have more than 5 disc diameters of retinal non-perfusion.



<https://www.mdpi.com/2077-0383/10/3/405>

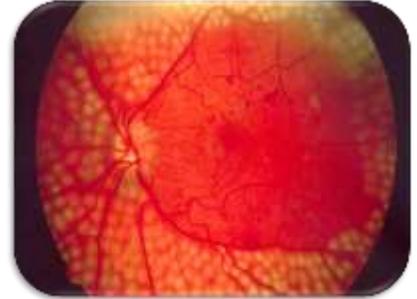
• When to do laser in RVO

- Panretinal photocoagulation (PRP) can induce the regression of neovascularization and reduce the development of vitreous hemorrhage by **50%**.



<https://www.mdpi.com/2077-0383/10/3/405>

- When to do laser in RVO



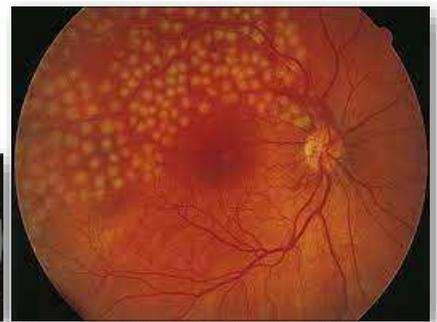
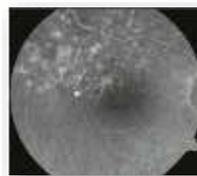
- In CRVO:

- In cases with (NVE, NVD) → PRP
- In cases with (NVI) at least 2 clock hours by gonioscopy → PRP
- Prophylactic PRP is not recommended, except in cases with Ischemic CRVO **that are not able to continue their follow-up visits.**
(even with no evidence of new vessels)



<https://www.aao.org/education/munnerlyn-laser-surgery-center/retinal-vein-occlusion>

- When to do laser in RVO



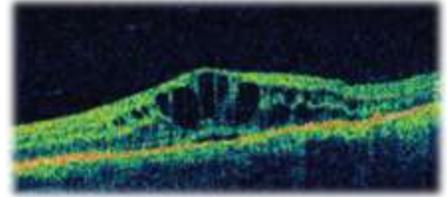
- In BRVO:

- Cases with VA ≤ 0.5 (decimal) without improvement in their vision for at least 3 months with areas of capillary non-perfusion > 5 disc diameters and new vessels → **Sector (scatter) laser photocoagulation.**

<https://www.aao.org/education/munnerlyn-laser-surgery-center/retinal-vein-occlusion>



- When to do laser in RVO



- In Refractory macular edema:

- Currently, the first line treatment for **macular edema** due to CRVO is **anti-VEGF therapy**.
- Macular grid laser** is **not** recommended, since it may reduce the macular leakage but without benefit on the visual acuity.

<https://www.aao.org/education/munnerlyn-laser-surgery-center/retinal-vein-occlusion>

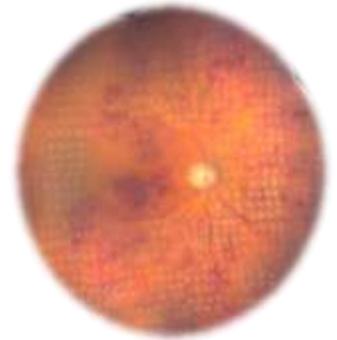


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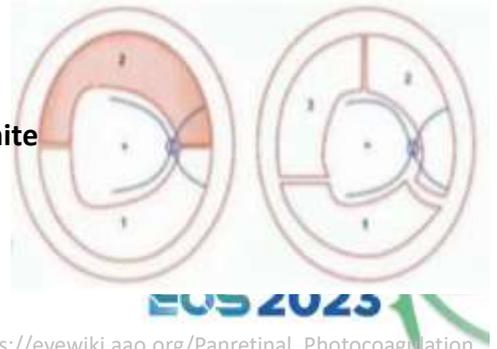
- Parameters of laser in RVO



- Pan-retinal Photocoagulation (PRP):**

(In CRVO cases with evidence of new vascularization)

- Number of shots: **1000–3000 burns**. spaced **one burn width** apart.
- Duration: **0.1– 0.2 second** (100-200 ms duration)
- Spot size of **200-500 μm**
- Energy: starting by **200 mW** to the endpoint of a **faint white retinal burn**.



https://eyewiki.aao.org/Panretinal_Photocoagulation

- Parameters of laser in RVO

- Pan-retinal Photocoagulation (PRP):**



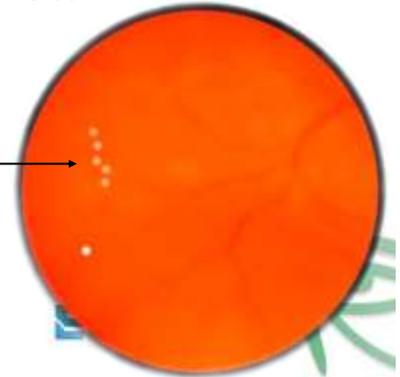
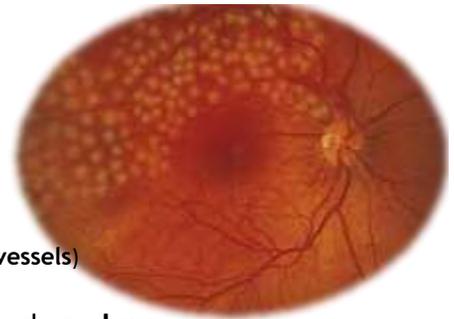
<https://www.youtube.com/watch?v=ly46iM4HRxc>

• Parameters of laser in RVO

• Scatter (Sector) laser photocoagulation:

(In BRVO cases with areas of capillary non-perfusion > 5 DD, (evidence of new vessels)

- Number of shots: **To cover the non-perfused area** (spaced **one burn width** apart), avoid **FAZ** and major vessels.
- Duration: **0.05 – 0.1 second** (50-100 ms duration)
- Spot size of **100 μm**
- Energy: starting by **100 mW** to the endpoint of a **faint white retinal burn**.



<https://www.aao.org/education/munnerlyn-laser-surgery-center/retinal-vein-occlusion>

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• Complications of Laser treatment

(should be discussed with your patient prior to treatment)

- Loss of peripheral vision.
- Bruch's membrane ruptures can occur with higher energy leading to subretinal hemorrhage and development of choroidal neovascularization or even break.
- Treatment over blood vessels can lead to their rupture and preretinal or vitreous hemorrhage.
- Affection of central vision if treatment is performed too close to the fovea (Central scotoma).

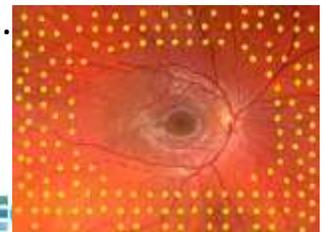


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<https://doi.org/10.1080/08820538.2017.1353820>

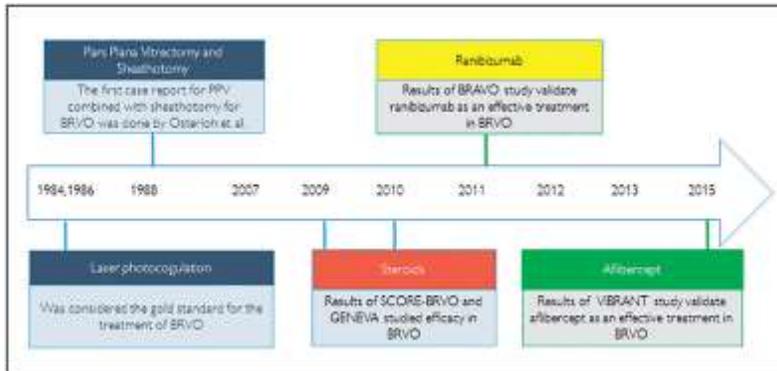
• Complications of Laser treatment

- **To reduce complications:**
- Use shorter duration is safer (pulses of 10-20ms).
- Avoid higher energy.
- Application of the laser in multi-spot pattern if possible.
- Use peribulbar anesthesia in uncooperative patients.



• Results of Clinical Trials

“regarding the role of laser in RVO”



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<https://retinatoday.com/articles/2022-nov-dec/clinical-trials-targeting-rvo?c4src=search/feed>

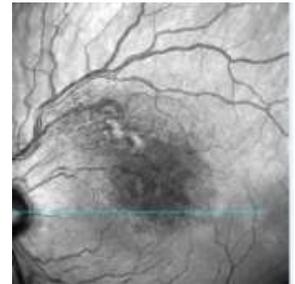
• Results of Clinical Trials



• Branch Vein Occlusion Study (BVOS): 1986

• The **BVOS** showed that younger patients with **refractory edema** secondary to BRVO and vision <6/12 (for 3 months), that were treated with **Grid laser** had better VA than untreated cases.

• Sectoral (scatter) argon laser in the distribution of the vein occlusion prevented neovascularisation and vitreous haemorrhage.



<https://webeye.ophth.uiowa.edu/eyeforum/cases/274-branch-retinal-vein-occlusion.htm>

• Results of Clinical Trials

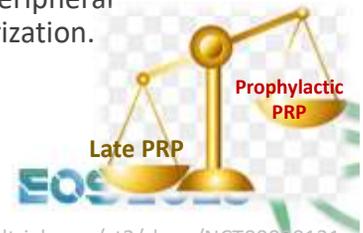


• Central Vein Occlusion Study (CVOS): 1994

The study recommended to perform PRP **only after** angiographic finding of New vessels or detection of NVI on gonioscopy (at least 2 clock hours),

- Cases treated with **late** laser (after evidence of new vessels) showed **4-folds less** chance of developing further neovascularization.

On the other hand, Cases treated with **prophylactic** laser lost their peripheral vision early, and showed higher incidence of late missed new vascularization.



<https://clinicaltrials.gov/ct2/show/NCT00000131>

• Results of Clinical Trials



• RELATE study (Ranibizumab dose comparison & Role of Laser in RVO) 2015

- The **RELATE** trial evaluated the combination of grid and scatter photocoagulation 24 weeks after treatment with the ranibizumab group for chronic ME.
- No additional benefits of laser in improvement of vision, resolution of macular edema, or reduced number of intravitreal injections.
- The study didn't recommend adding grid laser as an adjunctive treatment for ME 2ry to CRVO.



<https://pubmed.ncbi.nlm.nih.gov/25972260/>

• Results of Clinical Trials



• **VIBRANT study** (IntraVitreAl Aflibercept vs grid laser) 2015

- After 52 weeks, The study concluded that eyes treated from the start with monthly injections of **aflibercept** showed better visual and anatomical outcomes compared to laser group.



<https://pubmed.ncbi.nlm.nih.gov/25315663/>

• Results of Clinical Trials



• **BRIGHTER study** (Benefits of Ranibizumab with and without laser in BRVO) 2017

- 2 Years results of BRIGHTER study, **showed that ranibizumab groups had superior outcomes compared with the laser monotherapy.**



<https://pubmed.ncbi.nlm.nih.gov/28807635/>

- Points to be covered

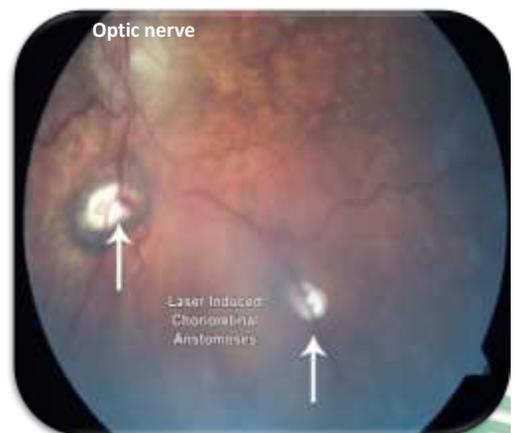
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- Other modalities in Laser therapy for RVO:

- Laser induced Chorio-retinal anastomosis (L-CRA)

- The principle is to use a **high-power argon laser** (*up to 3 Watt*) to create an anastomotic connection between an **obstructed retinal vein** and an underlying **choroidal vein** to bypass the obstruction of retinal venous outflow that occurs in RVO.

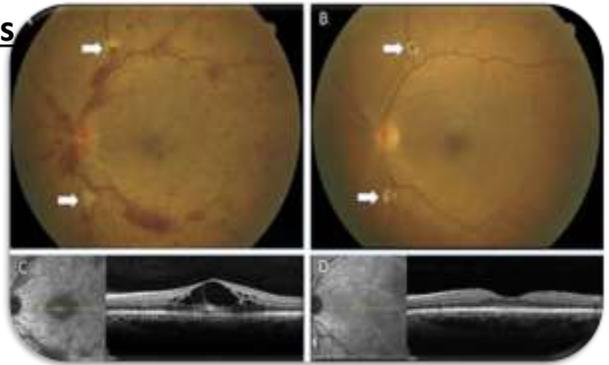


https://journals.lww.com/apjoo/Fulltext/2021/06000/Laser_Induced_Chorioretinal_Anastomosis_Can_Be_an.17.aspx

- Other modalities in Laser therapy for RVO:

- Laser induced Chorio-retinal anastomosis (L-CRA)**

Results of recent clinical trials showed that L-CRA aided in reducing the central Venous Pressure (CVP) and better visual outcomes were reported when combined with Anti-VEGF therapy (one month apart).



https://journals.lww.com/apjoo/Fulltext/2021/06000/Laser_Induced_Chorioretinal_Anastomosis_Can_Be_an.17.aspx

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• Take Home Message



• BRVO

- Our practice is currently to offer patients an intravitreal Anti-VEGF agent if macular edema is present at the time of diagnosis. If the edema resolves with only injections, then patients will be scheduled for monthly **visits**.

- Sector laser is applied after resolution of ME in cases with areas of capillary non-perfusion more than 5 D.D with documented new vessels.



- Grid laser is only done in cases with refractory Macular Edema 2ry to BRVO.



• Take Home Message



• CRVO

- Remember that **Anti-VEGF** therapy treat **Macular Edema** caused by upregulated cytokines and not the underlying cause, **new vessels should be treated with laser photocoagulation**.

- Results of **Laser induced Chorio-retinal anastomosis (L-CRA)** are promising as an adjunctive therapy to intravitreal Anti-VEGF which may aid in **reducing central venous pressure (CVP)**.



- **Take Home Message**



- The results reported in RCT are not reflected in clinical practice due to reduced frequency of Anti-VEGF injection in the real world and differences in baseline data.
- Pars-Plana Vitrectomy with endo-laser is needed in RVO cases with non-resolving vitreous hemorrhage.

