# Lasers for Rosacea, Telangiectasias & Vascular Lesions




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# Disclosures

- Endo
  - Investigator
- Galderma
  - Consultant
- Revelle
  - Consultant
- La Jolla Nanoparticle, Inc
  - Stock options
- Cytrellis, Inc
  - Intellectual property
  - Royalties
- Allergan, Inc.
  - Consultant

# What settings should I use?

- This is always the wrong question
- Here is why

# Selective Photothermolysis

- Rox Anderson & John Parrish
- Foundation of most lasers used in medicine today

# Selective Photothermolysis

- Selective thermal damage to an absorbing target is achieved with appropriate laser parameters such as wavelength, fluence, pulse duration with minimal damage to surrounding tissue

# Selective photothermolysis

- Must select a wavelength well-absorbed by target chromophore
- Pulse duration shorter than the target's thermal relaxation time
- Producing selective, localized heating with focal destruction of the target
- Minimal damage to surrounding structures

# Thermal relaxation time (TRT)

- The time required for the target tissue to lose half of its heat to its surrounding tissue
- Varies according to target tissue
- Key is to heat the target faster than the time required for heat conduction to surrounding tissue

# Thermal relaxation time

- The matching of TRT and pulse duration is clinically important to achieve efficacy, avoid side effects, and even to define the targets that will respond
  - E.G., a picosecond alexandrite laser will not effectively perform laser hair removal
  - However, a millisecond alexandrite laser will be highly effective

# Thermal relaxation times

- Leg veins: one second
- Capillaries: tens of milliseconds
- Hair follicle: hundreds of milliseconds
- Melanosome: nanoseconds, picoseconds
- Tattoo pigment: nanoseconds, picoseconds

# To Maximize Results: Avoid a cookbook approach

- Do not memorize settings
- Do not blindly replicate recommended settings from a colleague or a device manufacturer
- Some lasers are not externally calibrated
- Safe and unsafe laser endpoints and close clinical observation are the best means to avoiding complications

M Wanner, F Sakamoto, MM Avram, RR Anderson. Immediate skin responses to laser and light treatments: Therapeutic endpoints: how to obtain efficacy J Am Acad 2016; 74(5): 821-33.

# Vascular laser endpoints

- Depends on the condition you are treating
- Think of treatment from the standpoint of a dermatopathologist
- Vessel size is key
- So is the underlying pathophysiology

# Vascular laser endpoints

- Safe & Effective
  - Transient purpura
  - Vessel clearance
  - Purpura
- Unsafe
  - Graying
  - Tissue contraction

# High Energy, Short Pulse Duration

- Port Wine Stains
- Cherry Angiomas
- Thin telangiectasias
- Warts

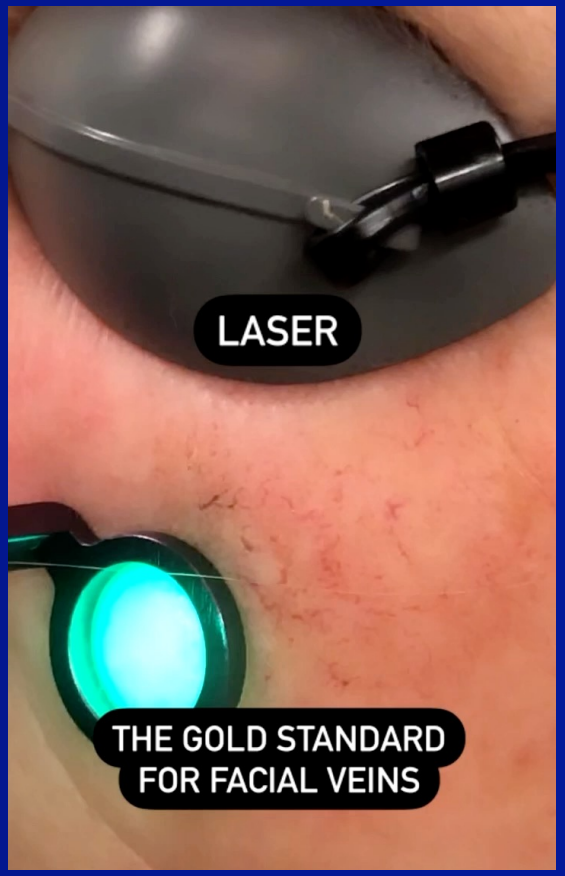
# Low Energy, Short Pulse Duration

- Scars
  - Hypertrophic, keloidal
- Striae rubra
- Hemangiomas
  - Ulcerated, non-ulcerated

Purpura is not required

# High Energy, Long Pulse Duration

- Larger telangiectasias
- Facial, superficial thin leg veins



# Low Energy, High Pulse Duration


Skin of Color
Rosacea, telangiectasia

# Skin cooling

# Skin cooling

- The use of appropriate use of skin cooling is crucial to safe & effective laser surgery
- It limits thermal damage to its intended target
- Thus, protecting the epidermis and superficial dermis while achieving focal selective destruction of deeper structures

# Skin cooling

- Cooling can be applied
  - before (pre-cooling),
  - during (parallel cooling); and
  - after the laser pulse (post-cooling)

# Types of skin cooling

- Direct solid contact cooling (E.g cold sapphire window)
- Automated cryogen spray (DCD™, direct cooling devices)
- Cold air cooling (i.e., Zimmer) has the advantage of bulk skin cooling, which limits pain, edema, and the risk of burns from residual heat.

# Clinical applications

# Laser Surgery: Know Your Safe & Unsafe Clinical Endpoints

- Vascular
  - Transient purpura/purpura; not graying
- Pigmented lesions/tattoos:
  - Whitening, dermal plumping; not splatter
- Hair removal
  - Perifollicular edema/erythema
  - No epidermal change/dermal tightening

# Vascular lesions

- Target chromophore: oxyhemoglobin
- Treatment of choice: pulse dye lasers

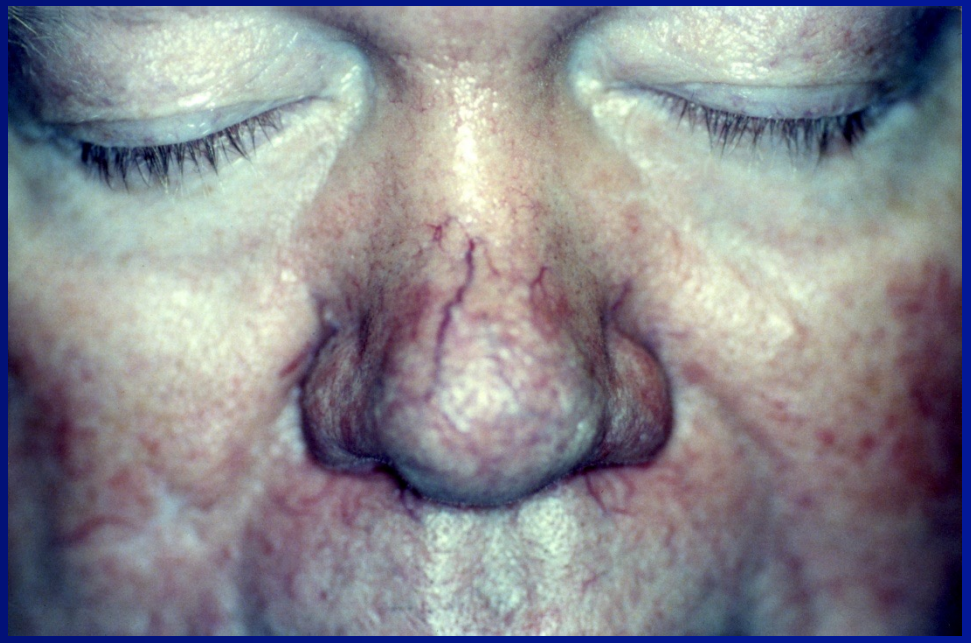
# PDL

- 585-600 nm
- Pulse durations of 0.45 - 40 ms
- Most effective treatment for PWS, hemangiomas & rosacea
- Post-treatment:
  - Erythema, swelling
  - Purpura x 7-14 days

# Mechanism of action

- immediate microvascular hemorrhage
  - Clinically manifested as purpura
- thrombosis
- delayed appearance of vasculitis

# Facial telangiectasias



# Immediate purpura at time of treatment

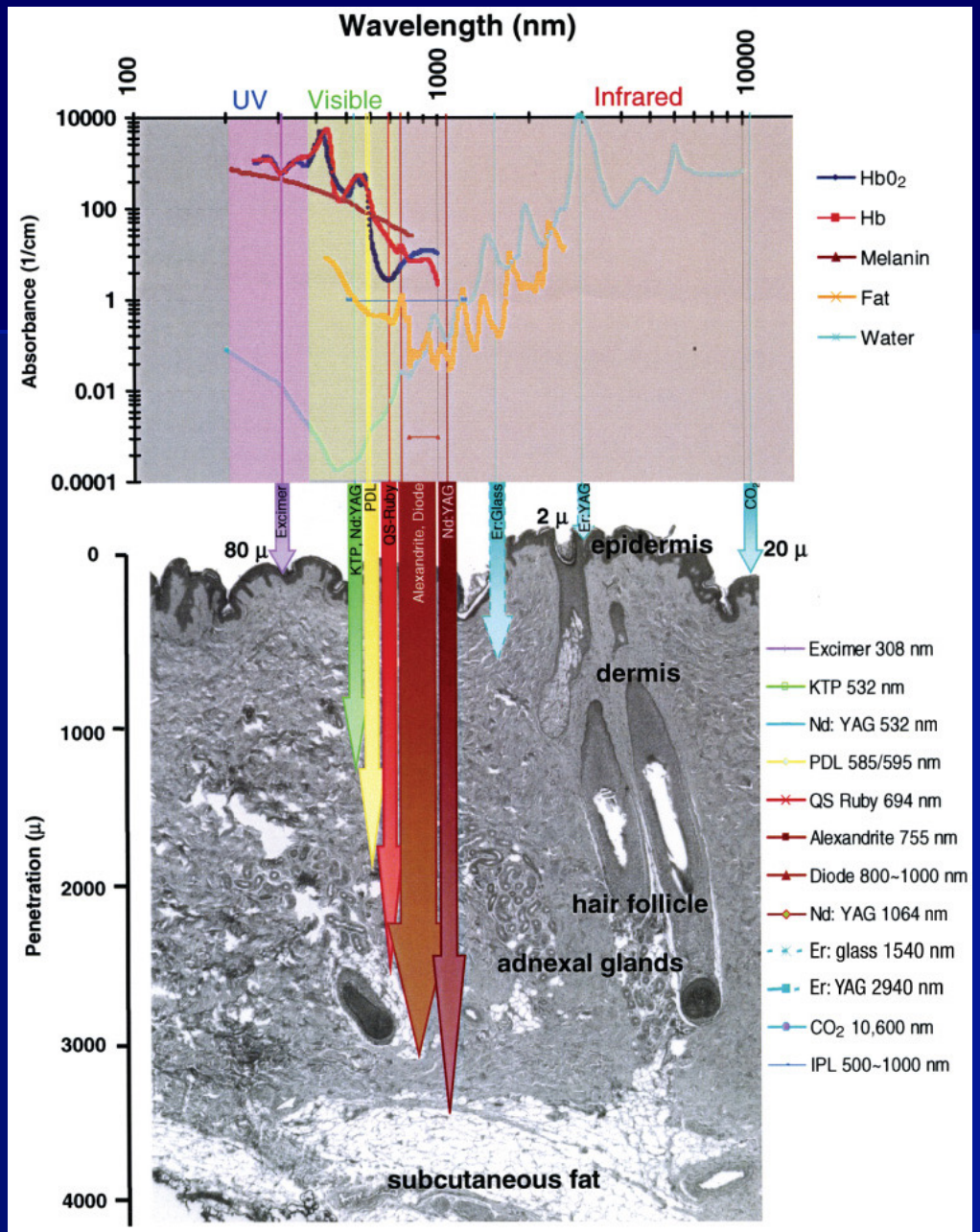
# Post-treatment improvement

# Variable-pulsed PDL

- Effective treatment based on correct pulse duration and energy
- Side effects:
  - temporary erythema and edema

# Vascular and non-vascular lesions amenable to PDL

- PWS
- Facial telangiectasias
- Rosacea
- Spider veins
- Hemangiomas
- Hypertrophic scars
- Cherry angiomas
- Poikiloderma of Civatte
- Striae
- Warts




Source: Wolff K, Goldsmith LA, Katz SI, Gilchrest BA, Paller AS, Leffell DJ: *Fitzpatrick's Dermatology in General Medicine*, 7th Edition: http://www.accessmedicine.com

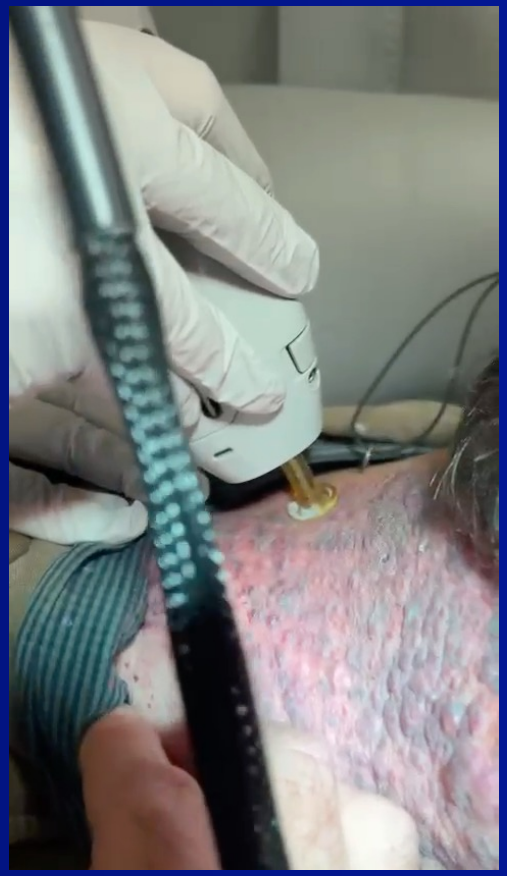
# Deeper vascular lesions, including PWS, do not respond well to PDL lasers

- New option: hair removal lasers:
  - 755nm long-pulsed alexandrite
  - 810nm diode laser
  - 1064nm Nd:YAG

# Pulsed dye lasers only go so far……

- Pulsed dye lasers are often only partly effective
- 585-595 nm wavelengths only offer limited treatment depth of penetration
  - ~1 mm in depth on the face
  - Only about ½ of dermal depth
- Thus, PDL cannot treat deeper components of PWS, hypertrophic PWS, venous malformations & venous lakes

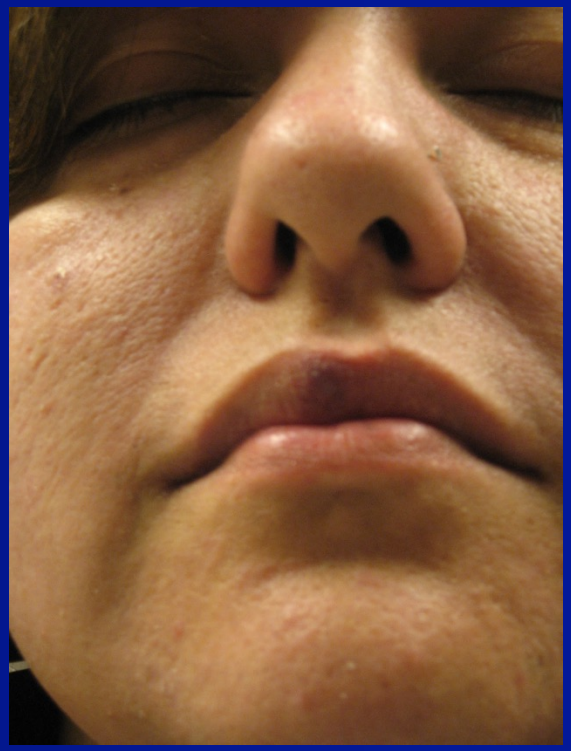
# 755nm Laser Hypertrophic PWS



# Venous lakes: 810nm diode laser

TL Wall, AG Grassi, MM Avram. Clearance of multiple venous lakes with an 800-nm diode laser: a new approach. Dermatol Surg 2007; 33(1): 100-03.

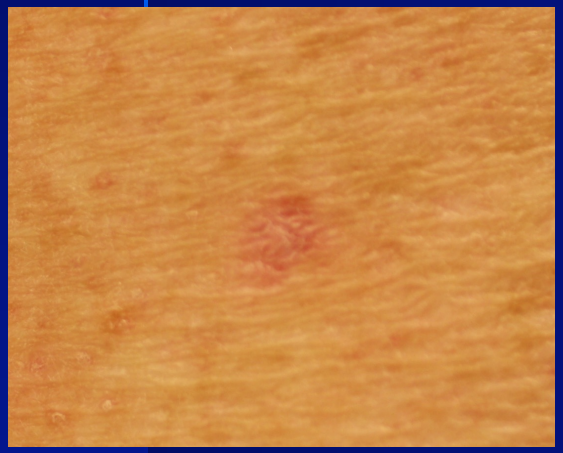
# Vascular malformation: 810 nm diode laser



ZS Tannous, RR Anderson, MM Avram. Treatment of Venous malformations with an 800nm diode laser. Lasers Surg Med 2010; 42 (3): 30.

# Venous Malformation 755 nm laser

# 1064 nm Nd:YAG laser for BCC



Pre-Tx

Immediately After Tx 1

4 weeks

AE Ortiz, RR Anderson, C DiGiorgio, S Jiang, F Shafiq, MM Avram. An expanded study of long-pulsed 1064 nm Nd:YAG treatment of basal cell carcinoma. Laser Surg Med 2018.

AE Ortiz, RR Anderson, MM Avram. 1064 nm long-pulsed Nd:YAG treatment of basal cell carcinoma. Laser Surg Med 2015; 47(2): 106-110.

# Conclusions

- Energy-based devices are highly effective for vascular concerns
- The key to successful treatment is an understanding of key clinical endpoints
- A basic foundation in the operation of lasers and other energy-based devices is required for safe and effective treatments

# Thank you