



LASERS: AN OVERVIEW

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OUTLINE

- What is a Laser?
- Vascular Lasers
- Pigment Lasers
- Hair Reduction Lasers
- Resurfacing Lasers
- Updates and Concluding Thoughts



WHAT IS A LASER?



WHAT IS A LASER?

- LASER = Light Amplification by Stimulated Emission of Radiation
- Many lasers named based on type of lasing medium they contain
- Not all cosmetic instruments are lasers (ex. BBL/IPL)

WHAT IS A LASER?

- 3 main chromophores: water, hemoglobin, melanin
- Theory of selective photothermolysis
- Factors to consider:
 - wavelength
 - pulse duration
 - fluence
 - cooling/epidermal protection



VASCULAR LASERS



VASCULAR LASERS

- Target: Hemoglobin (peak absorption 400-600nm)



VASCULAR LASERS

- Pulsed dye laser 585-595nm
- Diode 810-940nm
- KTP 532nm
- Long-pulsed Nd:YAG 1064nm

*IPL can also be used for vascular indications



VASCULAR LASERS

- Clinical endpoints:
 - Purpura
 - Vessel disappearance/greying

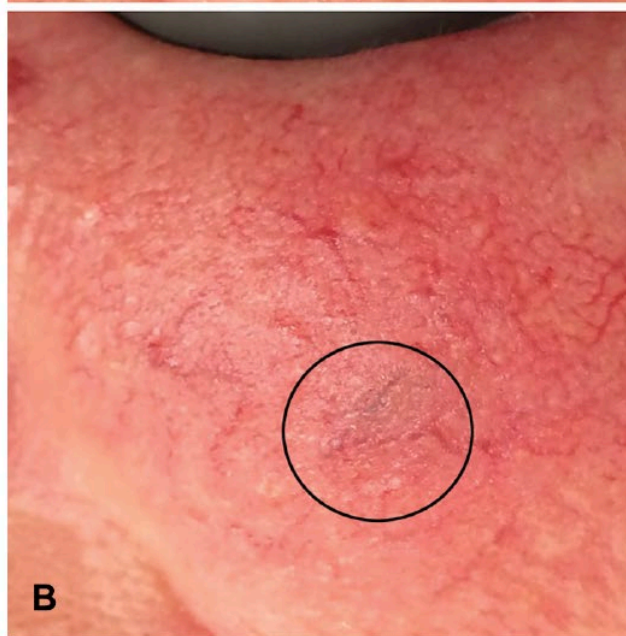


Fig 4. **A**, Telangiectasia before treatment with a pulsed dye laser. **B**, Transient vessel darkening after treatment with a pulsed dye laser (circled).

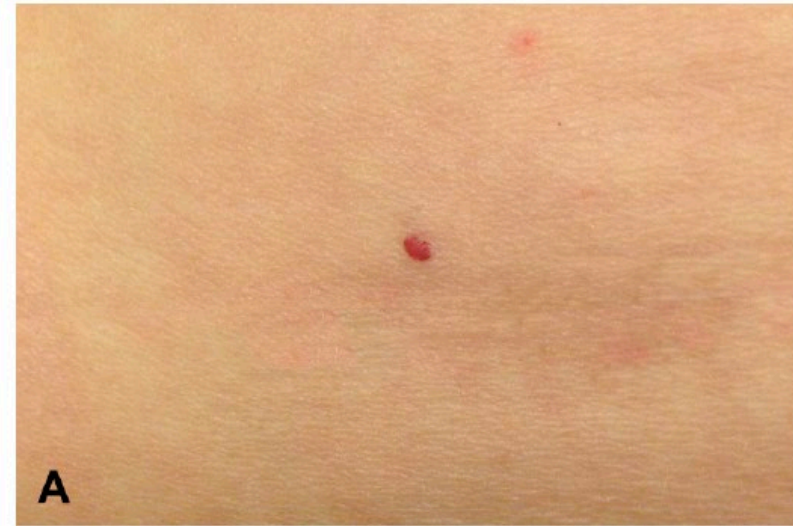


Fig 6. **A**, Cherry angioma before pulsed dye laser therapy. **B**, Purpura with surrounding erythema after pulsed dye laser therapy.

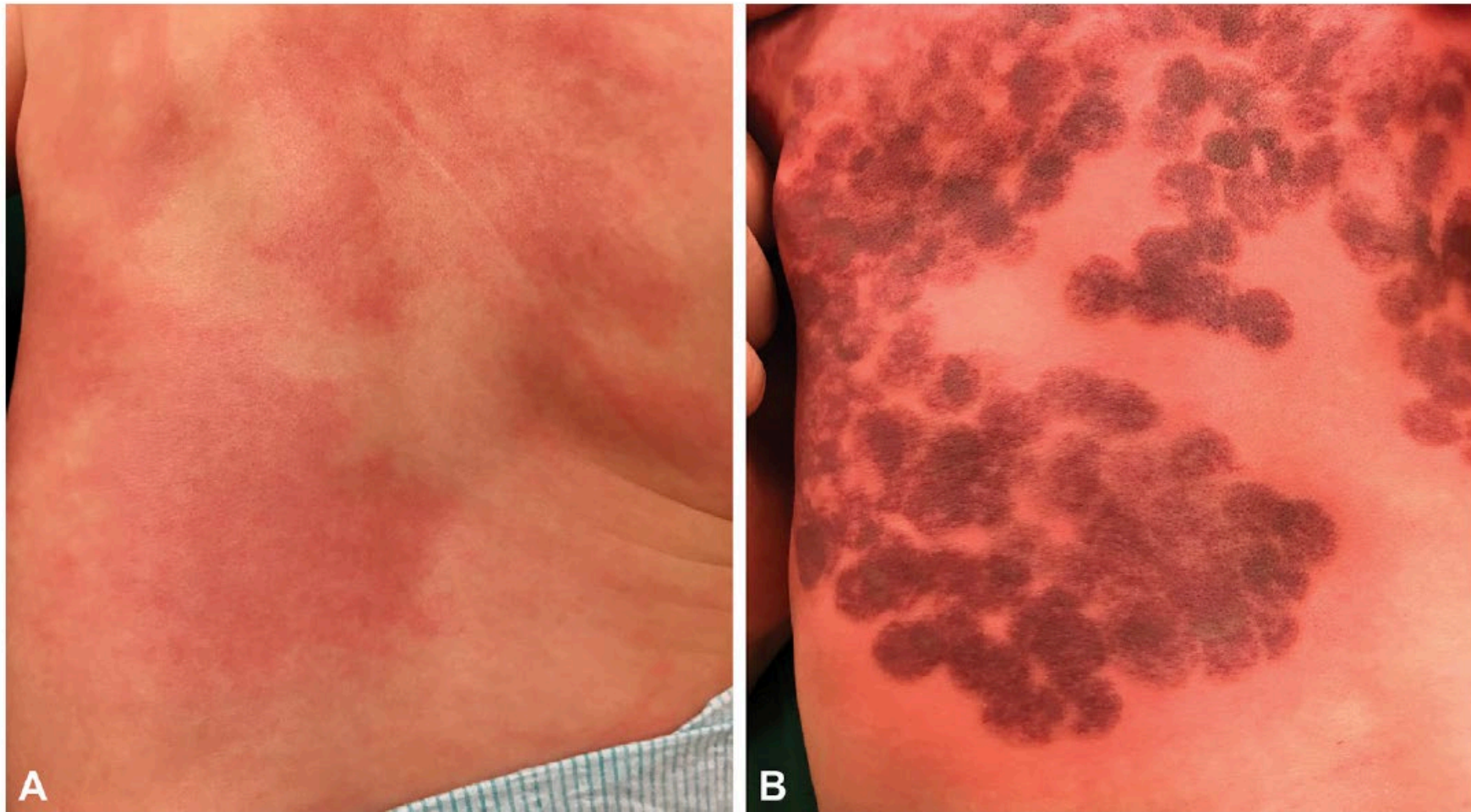


Fig 1. A, Before pulsed dye laser treatment. **B,** Immediate purpura is the appropriate endpoint for treatment of port wine stains. This baby was treated with pulsed dye laser (6.5 J/cm² fluence, 0.45 ms pulse duration, 12 mm spot size, DCD 30/20).



VASCULAR LASERS

Potential side effects:

- Purpura
- Blistering
- Post-inflammatory pigment alteration
- Scarring



PIGMENT LASERS



PIGMENT LASERS

- Target: Melanin
- Shorter pulse durations than vascular targets (can use Q-switched/nanosecond and picosecond lasers)





PIGMENT LASERS

- Clinical endpoint: whitening of lesion with preservation of surrounding skin
- Longer wavelengths better for deeper pigment and pigment in darker-skinned patients
- Shorter wavelengths for more superficial lesions and fair-skinned patients



PIGMENT LASERS

- Ruby laser
- Q-switched alexandrite 755nm
- Q-switched Nd:YAG 1064nm
- Frequency-doubled Nd:YAG 532nm
- Picosecond 532nm, 755nm, 1064nm

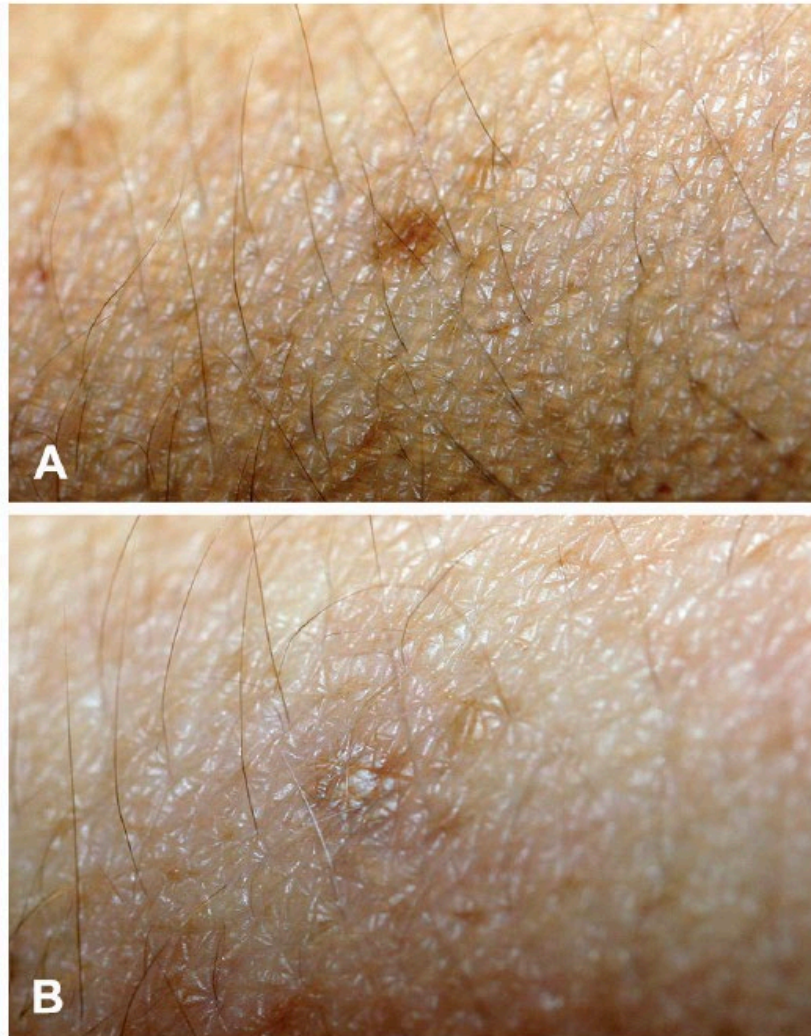


Fig 10. A, Lentigo before exposure with a Q-switched ruby laser. **B,** Immediate whitening after exposure with a Q-switched ruby laser. The response, caused by melanosome rupture, fades over several minutes.



PIGMENT LASERS

Potential side effects:

- Post-inflammatory pigment alteration

Caution in skin of color / tanned patients:

- Lasers cannot distinguish between normal melanin in natural/tanned skin and unwanted melanin



TATTOO REMOVAL LASERS



TATTOO REMOVAL LASERS

- Target: Tattoo ink
- Professional v amateur tattoos



TATTOO REMOVAL LASERS

- Clinical endpoint: greying/whitening of tattoo +/- gas bubbles with preservation of surrounding skin



A



B

Wanner M, Sakamoto FH, Avram MM, Chan HH, Alam M, Tannous Z, Anderson RR. Immediate skin responses to laser and light treatments: Therapeutic endpoints: How to obtain efficacy. *J Am Acad Dermatol.* 2016 May;74(5):821-33; quiz 834, 833. doi: 10.1016/j.jaad.2015.06.026. PMID: 27085228.

TATTOO REMOVAL LASERS

Color	Laser
BLACK	Ruby, Alexandrite, NdYAG 1064
BLUE	Ruby, Alexandrite, NdYAG 1064
BROWN	Ruby, Alexandrite, NdYAG 1064
GREEN	Alexandrite, Ruby
RED/YELLOW/ORANGE/VIOLET	NdYAG frequency-doubled 532
WHITE	NdYAG frequency-doubled 532* (+/- ablation)



TATTOO REMOVAL LASERS

Potential side effects:

- Blistering
- Post-inflammatory pigment alteration
- Scarring
- Tattoo darkening/oxidation (light/flesh-colored tattoos)



LASER HAIR REDUCTION



LASER HAIR REDUCTION

- Target: Melanin (→hair follicle matrix)



LASER HAIR REDUCTION

How to choose which laser?

- Hair color
- Hair caliber
- Patient's skin color

*white/grey/red/blonde hairs cannot be treated with laser

LASER HAIR REDUCTION

- Alexandrite 755nm
- Diode 800-810nm
- Nd:YAG 1064nm

*IPL can also be used, but is inferior to above methods



LASER HAIR REDUCTION

- Clinical endpoint: peri-follicular erythema and/or edema



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LASER HAIR REDUCTION

Potential side effects:

- Blistering/burns
- Scarring
- Folliculitis
- Hives
- Ulceration
- Post-inflammatory pigment alteration
- Paradoxical hypertrichosis
- Lidocaine toxicity



RESURFACING LASERS ABLATIVE AND NON-ABLATIVE



ABLATIVE RESURFACING LASERS

- CO2 10,600nm
- Erbium:YAG 2940nm

- Target: water





Fig 14. Small holes are seen immediately after treatment with fractional erbium laser. Each hole is about the size of a terminal hair, surrounded by a thin off-white collar of coagulated epidermis. Tissue fluid or blood usually leaks for several days from these holes.

NON-ABLATIVE RESURFACING LASERS

- Fractional 1440, 1540, 1550nm
- Fractional 1927nm
- Picosecond 1064nm (particularly great for photorejuvenation in SOC patients)

- Target: water





RESURFACING LASERS

Potential side effects:

- Blistering/burns
- Scarring
- Infection (HSV)
- Ulceration
- Post-inflammatory pigment alteration



FUTURE UPDATES/CONCLUDING
THOUGHTS

FUTURE OF LASERS IN DERM

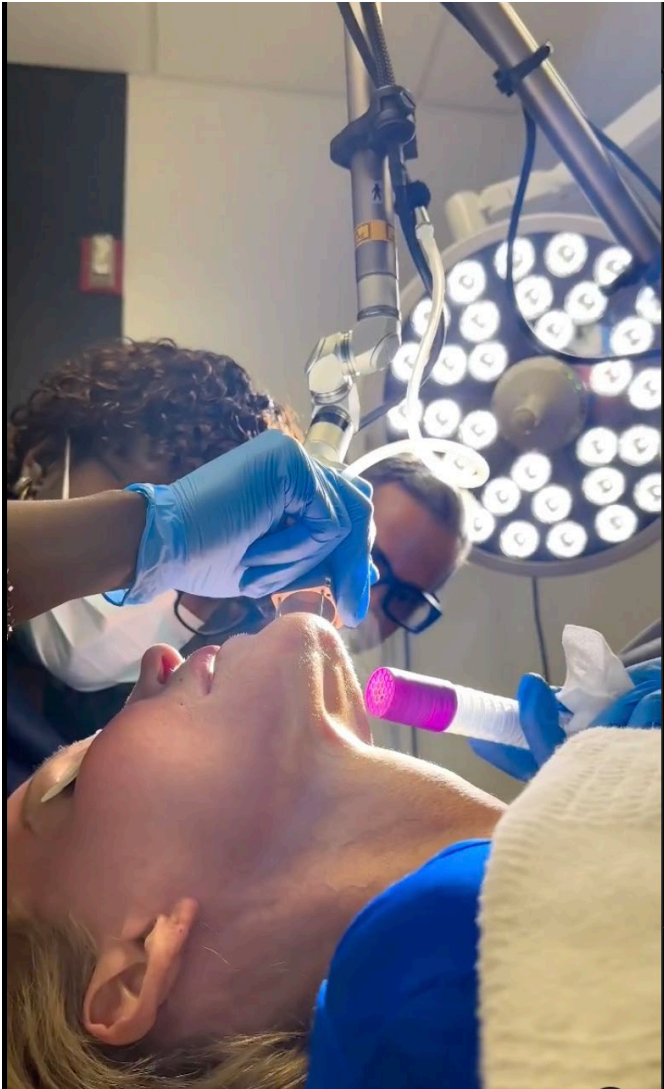
- Avicular (Cutera), Accure (Accure Acne): FDA cleared 1726nm lasers targeting sebaceous glands for acne
- Artificial intelligence
- Lasers for skin cancer
- Increased safety and efficacy of lasers in all skin types



CONCLUDING THOUGHTS

- Lasers are just machines
- Know your endpoints
- Test spots are your friend!
- Set patient expectations before firing laser
- Eye and fire precautions are non negotiable

THANK YOU



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