

# Laser treatments in children

Mercedes E Gonzalez, MD, FAAD

Pediatric Dermatologist, DERM 360

Medical Director, Pediatric Skin Research, LLC

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# Disclosures

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**Speaker &  
Investigator**

Abbvie, Arcutis  
Dermavant, Ely Lilly  
Krystal Biotech  
Pfizer  
Regeneron Pharmaceuticals  
Sanofi Genzyme  
Verrica Pharmaceuticals

**Investigator**

Amgen, Anterogen, Incyte  
Neilsen Biosciences, Novartis

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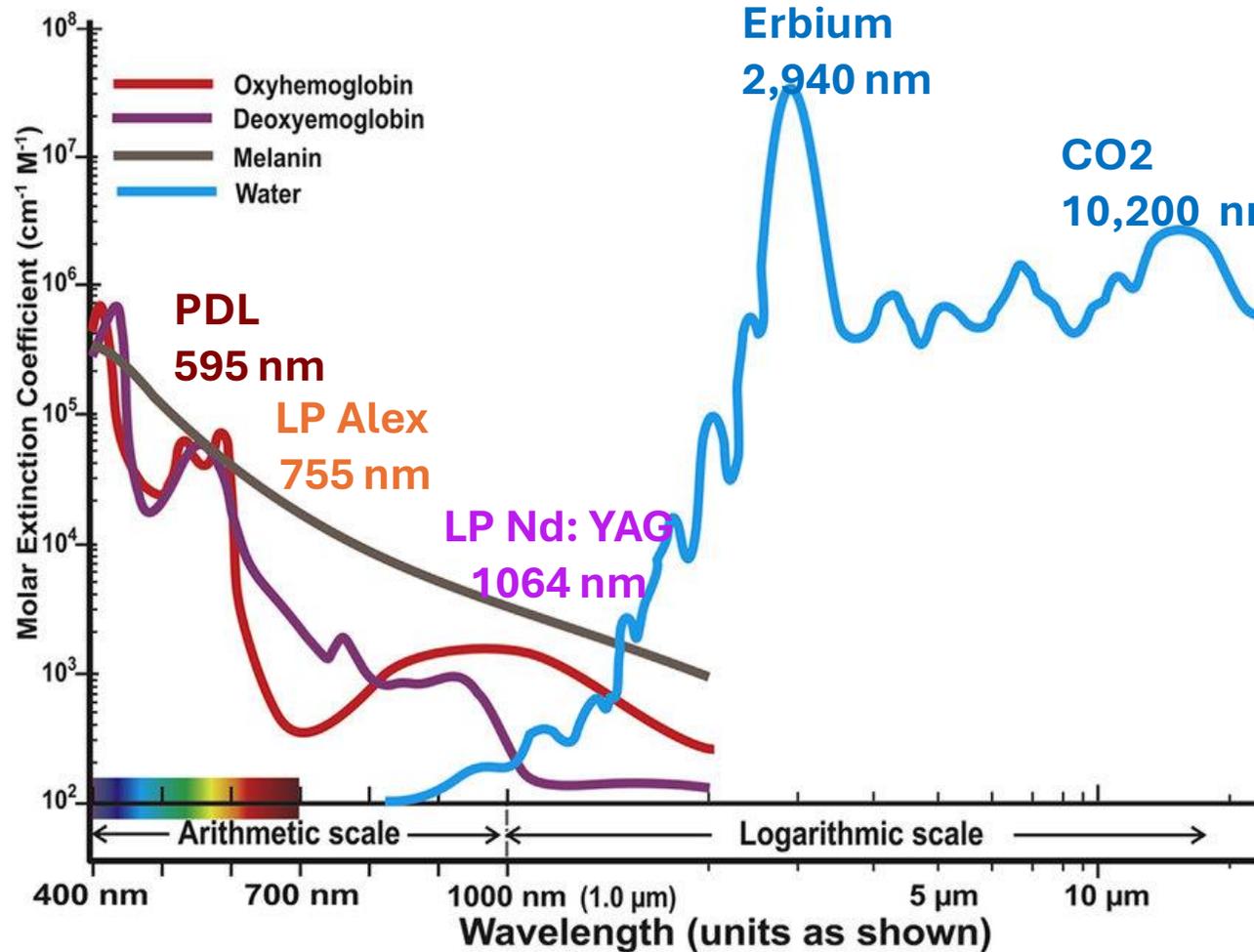
Abeona, Alphyn, Amyrt, Arcutis  
Cerave, Dermavant, Ely Lilly,  
Incyte, Noblepharma,  
Regeneron, Sanofi, Unilever, Inc  
Verrica Pharmceuticals

Off label uses of medications will be discussed

# Objectives

- Review the use of lasers in children/adolescents for
  - Vascular birthmarks
  - Hair removal
  - Scars, striae
- Provide safety and practice pearls
- Skin of color and pain & anxiety control

# Lasers target specific chromophores creating precise controlled damage while minimizing collateral injury



Condition	Target chromophore	Most appropriate laser
Port-wine birthmark	Oxyhemoglobin	595 nm PDL
Infantile hemangioma	Oxyhemoglobin	595 nm PDL; 1064 nm Nd:YAG for deeper components
Nevus of Ota	Dermal melanin	QS 1064 nm Nd:YAG or picosecond 1064 nm
Hair removal	Follicular melanin	755 nm alexandrite (lighter skin); 1064 nm Nd:YAG (darker skin)
Scars	Water (dermal remodeling)	Fractional CO <sub>2</sub> 10,600 nm or Er:YAG; PDL for erythema

# Clinical Endpoints: Real-time Tissue Response

- Laser settings cannot be generalizable across all device types for a specific wavelength of laser
  - Wavelength – selective absorption
  - Pulse duration – heat confinement (for vascular anomalies < TRT target blood vessel)
  - Fluence – exposure dose of energy
- Monitoring tissue response and clinical endpoints is critical, assess the efficacy of the treatment and allow for intraoperative fine-tuning of laser parameters

Target	Laser	Desired Clinical endpoint	Injury
Hemoglobin	PDL/KTP/Alex	Purpura/vessel darkening	Gray/white, blistering
	LP Nd:YAG vascular	delayed erythema/vessel contraction	Gray/white, blistering
Melanin	Alexandrite LP Nd:YAG	Perifollicular erythema/edema	Dyspigmentation
Pigment	Q-switched	Frosting/whitening + audible snap	Dyspigmentation

# Pulsed Dye Laser (595 nm) is gold standard for port wine birthmarks and infantile hemangioma

- **FDA clearance in June 2023** for pediatric treatment of **port-wine birthmarks (PWB)** and **infantile hemangiomas (IH)** from birth to adulthood



# PDL for PWB

- Target chromophores: oxyhemoglobin (418/542/577 nm peaks), deoxyhemoglobin (750–800 nm), methemoglobin (~620 nm)
- 595-nm PDL with integrated epidermal cooling is most commonly used
- Therapeutic endpoint: spot-limited purpura; metallic-gray blanching or skin shrinkage = nonspecific dermal injury → reduce fluence/improve
- Pulse duration should be  $\leq$  vessel thermal relaxation time; typical PWB vessels  $\sim 10\text{--}300\ \mu\text{m}$  →  *$\sim 1\text{--}10\ \text{ms pulses}$*
- Epidermal cooling enables higher fluence with less epidermal injury; avoid prolonged cooling that reduces superficial vessel temperature



FIGURE 3 Purpura immediately following treatment with pulse dye laser of a PWB that was delineated preoperatively with white marker



FIGURE 4 Small area of crusting following pulse dye laser treatment of a PWB. This resolved after a few days of emollient and did not lead to any scarring

# PWS Treatment recommendations

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- Treatment goals
  - Minimizing psychosocial impact, diminishing nodularity and hypertrophy
- Timing of treatment
  - Consensus recommendations favor **early treatment (ideally within the first year of life)** for higher efficacy and prevention of long-term complications
  - Some studies start as early as 2 weeks of age<sup>2</sup>
- Treatment frequency
  - Frequent intervals every 2 – 4 weeks
  - Q 2 -3 weeks had faster clearance than q 4 week<sup>3</sup>



1. Sabeti S, et al. JAMA Dermatol. 2021; 157:98-104

2. Chapas AM, et al. Lasers Surg Med. 2007;39(7):563-8.

3. Anolik R, et al. 2012;67(5):985-90.

# Port wine stain Treatment expectations

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- Complete clearance is rare
- Early treatment (<1 year) associated with higher clearance: ~26–32% complete clearance
- PDL can achieve 50%-90% clearance
- ~89–100% achieve >50% clearance in infant studies
- Most require eight to ten treatments (or more for optimal results)
  - Touch-up treatments are frequently needed

A





Before



After 18 treatments

# Port Wine Stain:

early treatment with **pulsed dye laser**

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# Port wine stain Treatment expectations

## Predictors of better response

- Lighter skin
- Face and neck
- Lateral face respond better than the central face
- Pink, red, and reticular lesions respond better than those that are
- Smaller lesions ( $<20 \text{ cm}^2$ ), bony areas

## More challenging to clear

- Darker skin types
- Extremity
- Proximal extremity lesions respond better than distal extremity lesions
- PWS associated with SWS
- More purple and geographic shaped



# PWB: Practical PDL Parameters + Refractory Options

- Typical PDL start: 7–10 mm spot; 8–12 J/cm<sup>2</sup>; 0.45–6 ms; DCD 20–30 ms spray with ~30 ms delay
- FST IV–V: longer pulse, larger spot, lower starting fluence to reduce PIH/scar risk
- Refractory/hypertrophic PWB: consider 755 nm alexandrite or combined PDL + LP Nd:YAG
  - More narrow therapeutic window
- Adjunct: topical rapamycin 1% daily up to 12 weeks post-laser may help select cases



FIGURE 5 Scarring from use of LP Nd:YAG laser on the face of a child with a PWB

# Laser treatment of PWS: Large survey results

- Survey of experts – Pediatric Dermatologist and Laser Specialists (n=141)
- 67.2% would begin treatment for PWS < 3 months old
- 24.8% would start < 1 mo old
- Intervals – 49.2% 1 month 32% every 2 months
- 60% treat in office for patients < 15 months of age
- Only 7.9% perform procedural anesthesia in an office based setting for >1-year-old
- When PWS plateaued with a 595 nm PDL, 38.4% providers would most likely try a combination of other wavelengths (e.g., 755 and 1064 nm) 32% use a different pulse duration
- For resistant or hypertrophic PWS, 64.0% of respondents do not use sirolimus.
  - Respondents in practice >20 years were less inclined to use sirolimus compared with other groups

# Infantile Hemangioma (IH): When to Use PDL

- Treat IH when risk of functional impairment, ulceration, or disfigurement is significant
- Propranolol is first-line for large/complex IH
- PDL best for:
  - Primary for small/flat IH
  - May prevent growth and accelerate plateau/involution
  - Residual telangiectasias
- Works best in combination: with propranolol or timolol
- **Pearl:** higher ulceration/scar risk than capillary malformations → avoid overlap/stacking
  - Ulcerated IH: conservative: 595 nm, 10 mm, 5–7 J/cm<sup>2</sup>, 1.5 ms, DCD 30/20)
  - Non-ulcerated: 595 nm, 10 mm, 7.75–9.5 J/cm<sup>2</sup>, 1.5 ms, DCD 30/20
- Residual Fibrofatty tissue: use fractional ablative CO<sub>2</sub> (example: 5–10% density, 20 mJ)

# IH treated with propranolol and PDL

- 5-week-old-boy
- Started on propranolol, added PDL



Infantile hemangioma



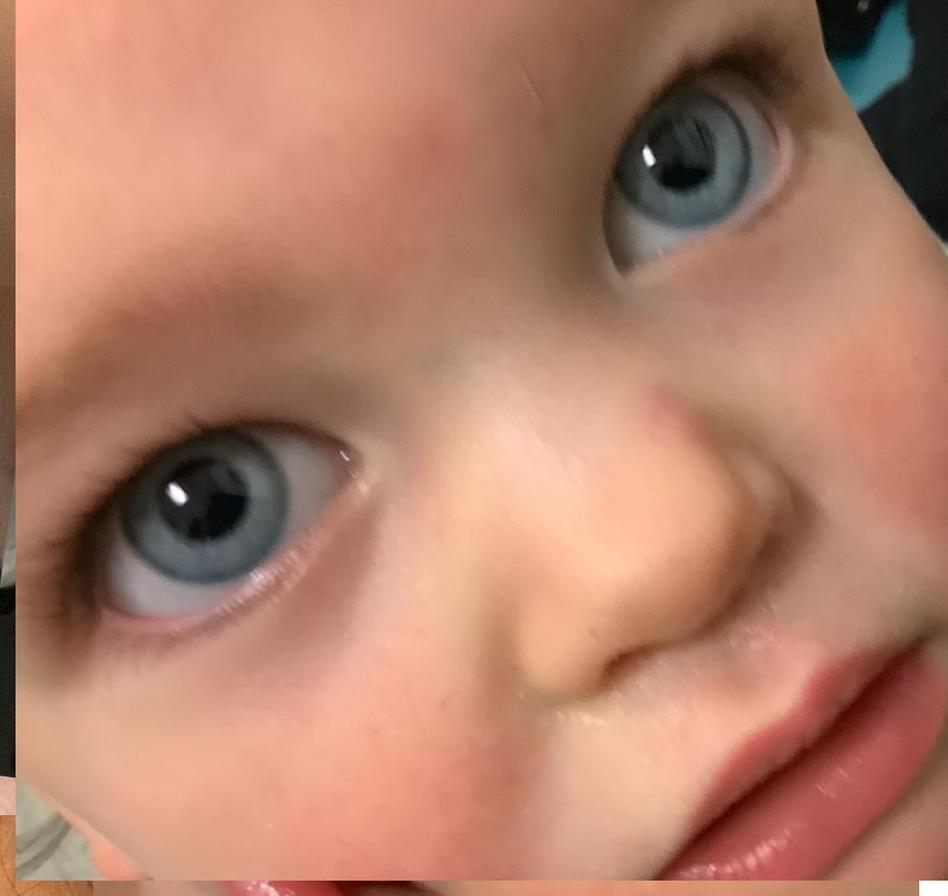
8 weeks of  
propranolol



24  
propranolol + PDL



12 months Propranolol & 7 PDL



PDL  
595 nm  
Therapy

# Safety of PDL for PWB and IH

- Large review: 33 journal articles, 7,725 total patients included
- Patient mix included PWB (n=2,033 total; 1,354 pediatric only) and IH (n=5,692 pediatric)

## **Safety**

- Permanent adverse effects were rare
  - PWB: 0.8% (16/2,033) permanent AEs (scarring/keloids/permanent pigment change)
  - IH: 0.2% (11/5,692) permanent AEs
- No severe ocular injuries reported (no blindness or serious injury)
- Most common temporary effects: edema, pain, blistering, crusting, transient PIH

# Pediatric Laser hair removal

## A review of hair removal modalities in pediatric patients: Ethical and clinical considerations

*Pediatric Dermatology*. 2024;41:410–420.

Eric Sanfilippo BS<sup>1</sup>  | Leslie Castelo-Soccio MD, PhD<sup>2</sup>  |  
Anna Yasmine Kirkorian MD<sup>1,3</sup>

- Most common cosmetic procedure in <18 years
- Treat when benefit is meaningful
- Child/adolescent is bothered and can assent
- Medical or QOL impact benefits outweigh risks
  - Eg: adjuvant in hidradenitis suppurativa by targeting follicles, pilonidal disease, folliculitis, CMN, hirsutism in PCOS
  - Hygiene burden, psychosocial distress
- Child can cooperate with positioning + eye protection
- Can cooperate with multiple sessions & strict sun protection for 6–8 weeks pre-treatment and ongoing to reduce competing pigment & complications

# Laser Hair Removal in Children & Adolescents is effective

- **Large review of 13 studies (2 cohorts + 11 case reports/series), 71 patients, ages 9 months–17 years**
- **Efficacy:** Most reports showed **significant hair reduction**
- **Safety: No scarring or dyspigmentation** reported across included studies
- **Pain = main limiting factor: 65%** required pain control (**ice 13%, topical 27%, GA 25%**)
- **Laser hair removal prior to puberty can lead to an increased chance of hair regrowth and render laser hair removal less effective when performed before puberty?**
- In pubertal females, the action of androgens promotes terminal hair growth; androgen excess promotes the development of hirsutism.
- To date, no scientific studies have provided data to substantiate the claim that laser hair removal in childhood or adolescence leads to an augmented hair growth pattern in adulthood it is likely that the patients treated with laser therapy before puberty continue to experience terminalization of remaining vellus hairs during puberty, giving the impression that the hair has grown back thicker

# LHR: Choose appropriate device to reduce dyspigmentation risk

**TABLE 1** Review of lasers used in pediatric hair removal.

Laser	Wavelength (nm)	Fluence	Fitzpatrick skin type	Indications	Ages treated	Results	Side effects
Long-pulsed ruby	694	6.5–19.5 J/cm <sup>2</sup>	Unspecified	<ul style="list-style-type: none"> <li>• Congenital melanocytic nevus (CMN)</li> <li>• Becker's nevus</li> <li>• Unwanted hair in isolation</li> <li>• Excess hair growth after skin graft</li> <li>• Anotia</li> </ul>	2–16 years	1–10 treatments with 89% patients experiencing reduction in hair; average of 63% reduction in hair counts at 6 months	<ul style="list-style-type: none"> <li>• Temporary blistering of CMN</li> </ul>
Long-pulsed alexandrite	755	16–27 J/cm <sup>2</sup> with continuous chilled air cooling; 16–32 J/cm <sup>2</sup> with cryogen cooling	II–IV	<ul style="list-style-type: none"> <li>• Generalized hypertrichosis</li> <li>• Constitutional hirsutism</li> <li>• PCOS</li> <li>• Nevoid hypertrichosis</li> <li>• Congenital melanocytic nevi</li> </ul>	11–15 years	Mean of 5.1 treatments; efficacy not mentioned	<ul style="list-style-type: none"> <li>• Discomfort (requiring fluence adjustment)</li> </ul>
Diode	800	10–12 J/cm <sup>2</sup>	III	<ul style="list-style-type: none"> <li>• Hypertrichosis lanuginosa congenita</li> </ul>	9 months	20 sessions with 80% hair reduction	<ul style="list-style-type: none"> <li>• None</li> </ul>
Long-pulsed neodymium: yttrium-aluminum-garnet (Nd:YAG)	1064	20–35 J/cm <sup>2</sup> with chilled contact sapphire tip; 16–25 J/cm <sup>2</sup> with cryogen cooling	IV–VI	<ul style="list-style-type: none"> <li>• Generalized hypertrichosis</li> <li>• Constitutional hirsutism</li> <li>• PCOS</li> <li>• Nevoid hypertrichosis</li> <li>• Congenital melanocytic nevi</li> </ul>	5–15 years	Mean of 6.2 treatments; efficacy not mentioned	<ul style="list-style-type: none"> <li>• Discomfort (requiring fluence adjustment)</li> <li>• Pain</li> <li>• Erythema</li> <li>• Edema</li> </ul>
		60–75 J/cm <sup>2</sup> with topical anesthetic cream	IV	<ul style="list-style-type: none"> <li>• Hypertrichosis secondary to topical minoxidil</li> </ul>	8 years	Total reduction after two sessions	<ul style="list-style-type: none"> <li>• Mild pain</li> <li>• Erythema</li> <li>• Perifollicular edema</li> </ul>

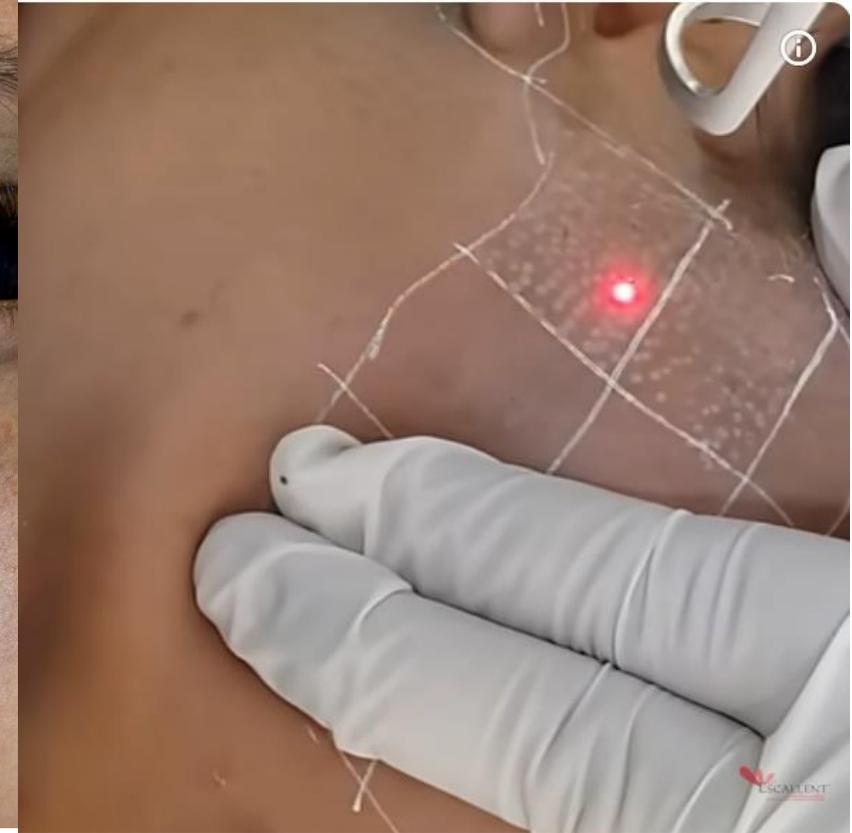
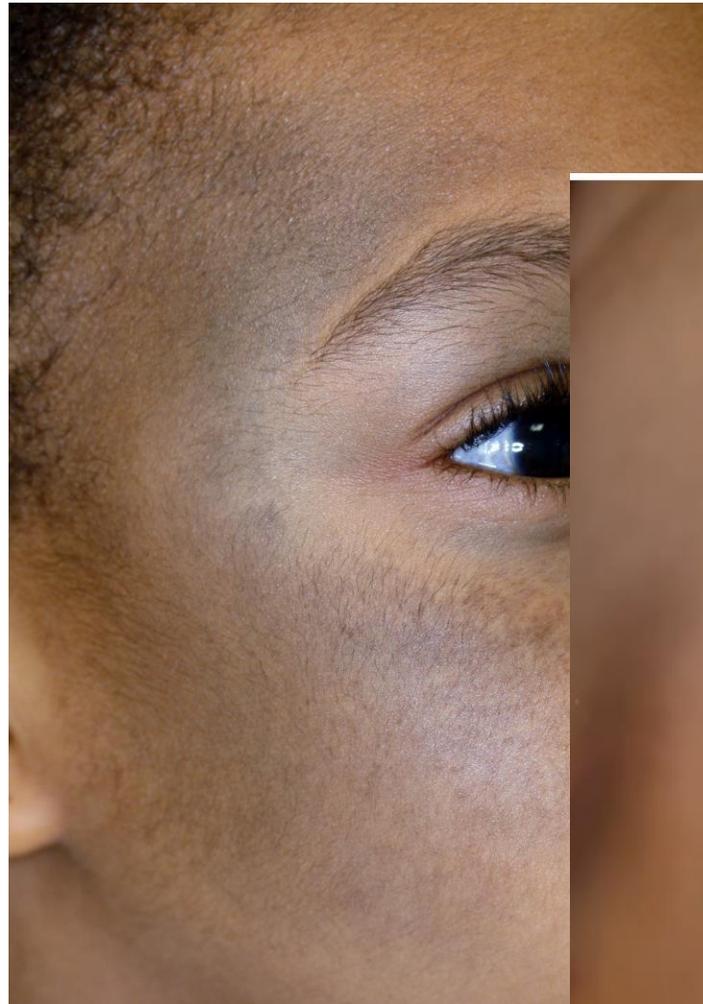
# Pediatric Hair Removal: Device Selection + Clinical Endpoint

- Target chromophore: melanin within follicle
- Device selection: LP alexandrite 755nm or Diode 800 nm for lighter skin; LP Nd:YAG 1064 preferred for darker skin FST IV-VI
- Endpoint: perifollicular erythema/edema (erythema may be delayed up to ~5 min)
- **Pearl:** Vascular laser treatment in hair-bearing areas may cause temporary/permanent hair loss (e.g., eyebrow)



# Nevus of Ota

- Q-switched lasers effective
- Early treatment improves outcomes, requires multiple sessions
- QS options: ruby 694, alexandrite 755, Nd:YAG 1064
- Endpoint: immediate frosting/whitening + audible snap/crack
- Periocular cases require strict ocular protection





(A) Before treatment; (B) 6 months after the first treatment; (C) 6 months after the third treatment; (D) 2 years after the 4th treatment.



(A) Before treatment; (B) 6 months after the first treatment; (C) 6 months after the fourth treatment; (D) 2 years after the 4th treatment.



(A) Before treatment; (B) 6 months after the fourth treatment; (C) 3 years after the 5th treatment.

Zheng H, Xu AE, Qiao G, Sun XY, Deng J, Zhang Y. Results and Follow-Up of a Sequential Q-Switched Laser Therapy for Nevus of Ota in Infants. *Clin Cosmet Investig Dermatol.* 2024;17:339-347

# Lasers for scar revision in children

- Goals: ↓ erythema/vascularity, ↓ thickness/elevation, ↑ pliability/ROM, smoother texture, ↓ dyspigmentation, ↓ pruritus/pain (symptom relief is a common endpoint in pediatric burn scars)
- Target chromophore: water (dermal remodeling) or hemoglobin
- Ablative resurfacing options: Er:YAG 2940 nm and CO<sub>2</sub> 10,600 nm
- Non-ablative:
  - 1540 – 1550 nm Fraxel: Texture improvement
  - PDL 595 nm & Long-pulsed Nd:YAG 1064: Erythema
- Fractionation speeds recovery by leaving untreated skin bridges
- Used hypertrophic, burn, traumatic scars, striae
- Treat every 4–8 weeks
- Anesthesia planning is age & extent-dependent: topical vs general
- Post-care: cold compress 24–48h, petrolatum until healed, sun protection; return to activity often 0–3 days



**FIGURE 7**

A, Three-year-old girl with symptomatic hypertrophic scars ~3 months after surgical revision of a scar contracture that developed after total parenteral nutrition infiltration in the NICU within the first 2 weeks of life. In addition to symptoms such as pain and itch, scar contractures resulting from hypertrophic scars may lead to functional issues that are exacerbated in the developing child. B, Patient ~11 months after a series of combination treatments with intralesional steroids, pulsed-dye laser, and ablative fractional laser resurfacing. Intervention can be instituted relatively early after surgery to mitigate development of hypertrophic scars and contractures. Although some gradual spontaneous improvement is anticipated for hypertrophic scars over months and years, the rapidity and extent of improvement with appropriate procedures exceeds that expected with spontaneous improvement alone. C, Patient ~2 years after initial presentation, asymptomatic and fully functional after additional pulsed-dye laser treatments to residual erythematous scars.



**FIGURE 6**

A, Twelve-year-old boy with a hypervascular/erythematous, pruritic, hypertrophic sternotomy scar after several life-saving heart surgeries that occurred when he was an infant. B, Postoperative photo showing the sternotomy scar after 2 sessions, ~2 months apart, of pulsed dye laser. The patient reported less erythema, less discomfort, and an overall "softening" of his scar.



Clinical endpoint: even  
edema mild erythema

IH & ulcer → scar: Propranolol + PDL  
+ Fraxel 1540 nm non-ablative



Striae: 6 sessions of PDL + Fraxel  
1540 nm non-ablative

# Laser pearls for pediatric SOC

- Consider longer wavelengths, lower fluence, longer pulse durations, and lower densities for resurfacing to reduce thermal injury and PIH risk
- PDL effective for vascular lesions in FST IV–VI → continuous skin cooling recommended
- Shorter pulse duration (picosecond) platforms may reduce epidermal melanin absorption and adverse effects for nevus of Ota
- Early laser intervention may improve outcomes for PWB + nevus of Ota
- Long-pulse 1064 nm Nd:YAG may be suitable for hair removal in FST IV–VI
- Fractional ablative CO<sub>2</sub> (10,600 nm) can improve traumatic/surgical scars in pediatric FST IV–VI (watch PIH risk).
- Cooling is essential: protects epidermis and may reduce pain, yet some data suggest cooling can also influence PIH risk in pigmentary conditions
- **Pearl: TEST SPOT is key**

# Pain/anxiety management for pediatric laser treatments:

- Prep: patient selection, set expectations
- Use topical anesthesia
- Distraction
- Ice
- Positioning is key
- Music, toys, rewards



sent to Arch Dermatol. 2008;144(11):1476. © AMA.



# Topical Anesthesia Pearls for Pediatric Laser

## Most useful options in clinic

- **LMX-4 (liposomal lidocaine 4%)**

- **Onset:** 20–30 min; **no occlusion needed**; OTC availability

- **Pearl:** less vasoconstriction than EMLA → **vascular lesions may be easier to visualize** before treating.

- **Peds dosing pearl:** avoid applying to **>100 cm<sup>2</sup>** per use in children (reduce systemic exposure risk).

- **EMLA (lidocaine 2.5% + prilocaine 2.5%)**

- **Onset:** ~1 hour (peaks 2–3 h), **depth:** ~3 mm at 60 min, ~5 mm at 120 min

- **How to apply:** thick layer + **occlusion** (e.g., Tegaderm)

- **Pearl:** early vasoconstriction **does NOT significantly impair vascular laser efficacy** (helpful for PDL planning).

# Multimodal Pediatric Pain Control

## Adjuncts by age

### Children + adolescents

- **Vibration/cold devices (Buzzy®):** place ~5 cm proximal for 30–60 sec
- **Virtual reality (VR):** meta-analysis of RCTs shows VR can **reduce pain** during needle procedures; also reduces anxiety in pediatric dermatology clinic workflows
- **Environmental prep:** block line-of-sight to the field; music/video reduces anxiety and can improve tolerance

### Infants

- **Oral sucrose 24%:** minimal effective dose **0.1 mL (1 drop)** for brief painful procedures; give ~2 min prior, effect lasts ~7–8 min
- **Breastfeeding / skin-to-skin (“kangaroo care”)** can reduce procedural pain and is comparable to sucrose in studies

# Eye Safety: Non-negotiables for Pediatric Laser Procedures

- Confirm wavelength-specific eyewear for all personnel
- Use opaque eye pads for facial treatments
- Metal corneal shields for periorbital work
- For within orbital rim: metal shields + anesthetic eye drops + nonflammable lubricating gel
- Ensure proper fit, compliance of goggles; treat eye protection as part of the time-out

# Summary

- Pediatric laser surgery is generally safe and effective when indications are appropriate and eye protection is non-negotiable.
- There are no universal settings—start conservatively, use test spots, and titrate to the clinical endpoint.
- Vascular birthmarks: earlier treatment often improves clearance and may prevent hypertrophy/nodularity over time.
- Skin of color: use longer wavelengths, longer pulse durations, lower fluence or density, aggressive cooling, and strict photoprotection to reduce PIH risk.
- Scars, striae, IH sequelae respond best to combination approaches plus thoughtful pain & anxiety management.

Thank you!