Lasers and Cosmetics Update

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Disclosures

Consultant/Speaker/Researcher:

- Allergan
- Medicis/Valeant
- Cynosure
- Cutera

Learning Objectives

- General Cosmetic Overview
  - Botox, Fillers
- Lasers
  - Cosmetic and medical use

Botox

- Botox – Botulinum toxin A (onabotulinumtoxinA, Allergan)

- Other preparations:
  - Dysport (abobotulinumtoxin A, Galderma)
  - Xeomin (incobotulinumtoxinA, Merz)

  .

  All have the same 150 kDa molecule at their core

Botox

- Causes chemodenervation of muscles by blocking release of acetylcholine
- Injections that weaken or relax muscles can smooth hyperfunctional lines and change the contour of the face and neck
- Aesthetic use, hyperhidrosis

Complications

- Brow ptosis
- Eyelid ptosis
- Epiphora (Excessive tearing)
- Diplopia
- Dry Eyes
- Mouth incompetence
- Difficulties in speech

Fillers (Soft Tissue Augmentation)

- Used to smooth out superficial wrinkles and folds
- Treatment of scars
- Lip augmentation
- Loss of subcutaneous fat

Fillers (Soft Tissue Augmentation)

- Hyaluronic Acid
  - E.g. Restylane, Juvederm, Belotero
- Synthetic
  - Poly-L-lactic acid (Sculptra)
  - Calcium hydroxylapatite (Radiesse)
  - Polymethylmethacrylate microspheres with bovine collagen (Belafill)
  - Silicone
- Autologous
  - Fat

Filler Complication

Immediate

- Pain
- Erythema
- Itching
- Swelling
- Bruising
- Visible material, Tyndall Effect
- Injection-site necrosis

Early

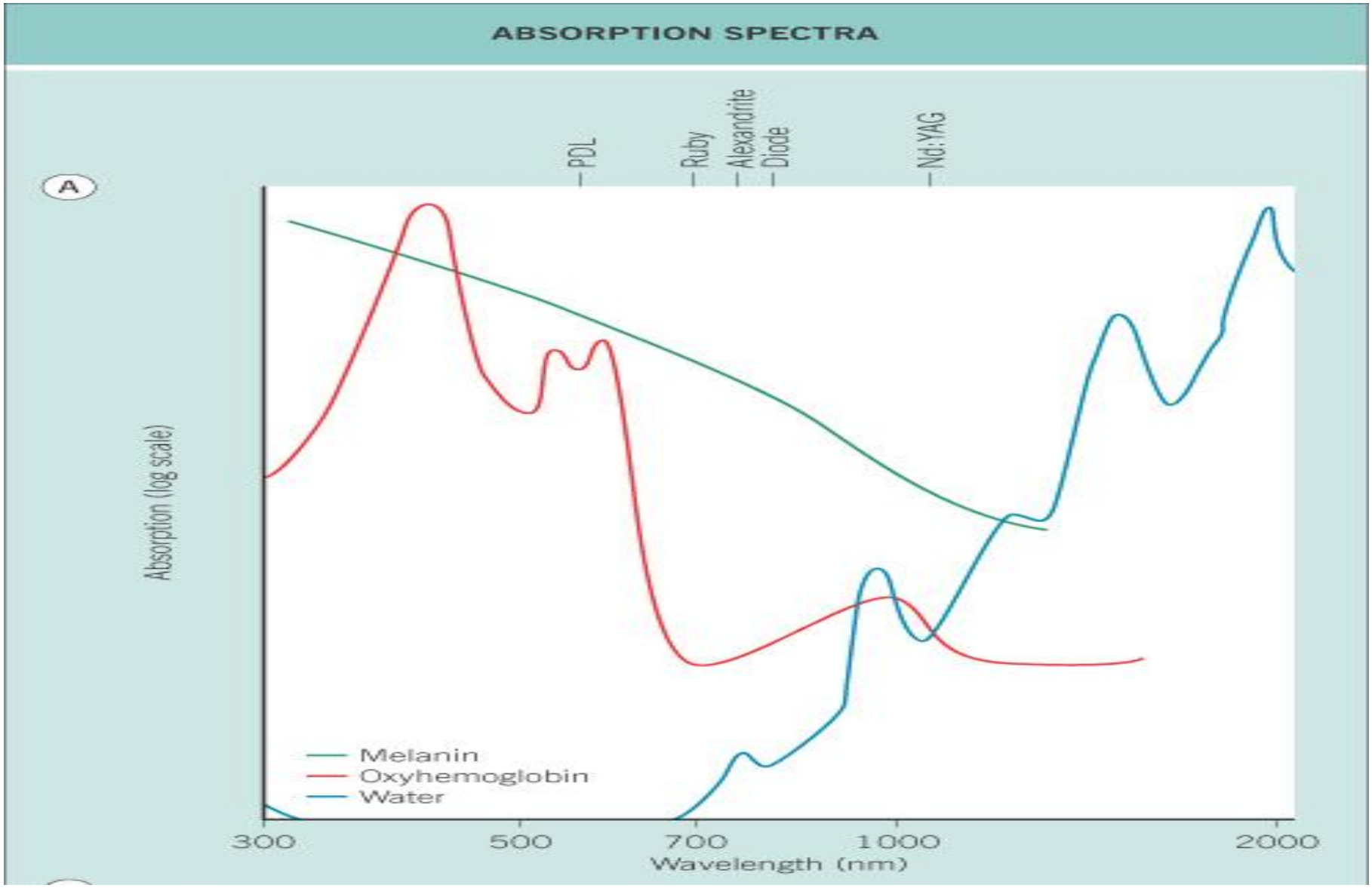
- Noninflammatory nodules
- Inflammatory nodules
- Hypersensitivity reactions (eg. angioedema)

Late

- Foreign body granulomas
- Delayed
- Biofilm

Lasers

- Light Amplification by Stimulated Emission of Radiation
- Vascular Lasers
- Pigment Lasers
- Laser Hair Removal
- Laser Skin Resurfacing


ABSORPTION SPECTRA
A
PDL
Ruby
Alexandrite
Diode
Nd:YAG
Absorption (log scale)
Melanin
Oxyhemoglobin
Water
300
500
700
1000
2000
Wavelength (nm)

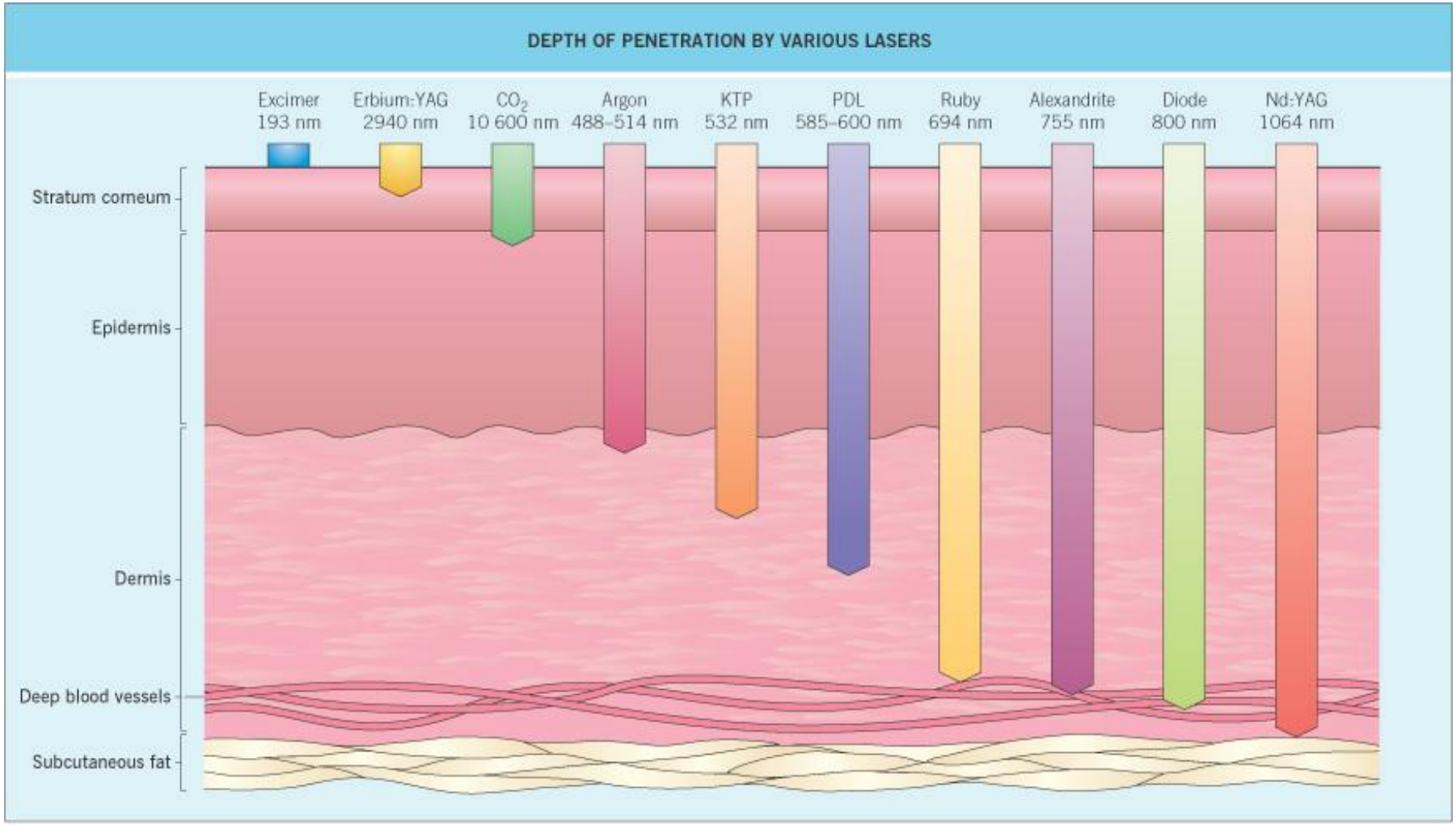


Fig. 136.8 Depth of penetration by various lasers. KTP, potassium titanyl phosphate; Nd, neodymium; PDL, pulsed dye laser; YAG, yttrium aluminum garnet.

Visible light: Increasing spot size will increase depth of penetration

Selective photothermolysis

- Targeted destruction of a specific structure
- Pulse duration ≤ thermal relaxation time

Table 136.2 -- Pulse durations and targets of selective photothermolysis.

PULSE DURATIONS AND TARGETS OF SELECTIVE PHOTOTHERMOLYSIS			
Chromophore	**Diameter**	**TRT**	**Typical laser pulse duration**
Tattoo ink particle	0.1 μm	10 ns	10 ns
Melanosome	0.5 μm	250 ns	10–100 ns
PWS vessels	30–100 μm	1–10 ms	0.4–20 ms
Terminal hair follicle	300 μm	100 ms	3–100 ms
Leg vein	1 mm	1 s	0.1 s

PWS, port-wine stain; TRT, thermal relaxation time.

Laser parameters

- Wavelength
- Fluence (J/cm^2) or Power (Watts)
- Pulse duration (seconds)
- Spot size (mm)
- +/- Cooling (Dynamic, Contact, Cold Air)
- Exam question : Irradiance (W/cm^2)

I. Vascular Lasers

- Remember your absorption spectrum!
- Chromophore is Hemoglobin
  - Oxyhemoglobin
  - Methemoglobin

Vascular Lasers

- **Pulsed-Dye Laser** (585-595 nm)
  - Pulse-stacking – hit the vessel multiple times (up to 4) to gradually increase vessel temperature and convert oxyhemoglobin to methemoglobin (better absorption at 595)
- **KTP laser** (532 nm)
  - Great for tracing vessels, less purpura
- **Long-pulsed Infrared lasers** (Long pulsed Alex, Long pulsed Nd:YAG)
- **IPL**
  - Both superficial and deep vessels

II. Pigmented Lesions

- Chromophores
  - Melanin
  - Tattoo particles
  - Drug-induced
- Indications
  - Lentigines
  - Nevus of Ota
  - Drug-induced pigmentation (e.g. Minocin)
  - Melasma and PIH - questionable

II. Tattoos

- Photoacoustic effects – ideally need very short pulsed lasers
- QS lasers – nanosecond
  - Ruby: 25-40 ns (Rubystart: 40ns)
  - Alex: 45-75 ns (Trivantage: 50ns)
  - Nd:YAG: 5-7 ns
- Picosecond lasers

Color	Pigment	Lasers
Traumatic	Lead, dirt,	**QS ND:YAG**, QS ruby, QS alex
Black	Carbon, iron oxide	QS ND:YAG, QS ruby, QS alex
Blue	Cobalt	
Green	Chromium oxide	QS ruby, **QS alex**
Red	Mercury sulfide (cinnabar), Cadmium selenide	**QS Nd:YAG (532)**
Yellow	Cadmium sulfide	QS Nd:YAG (532)
Brown	Ochre	QS Nd:YAG (532) QS ND:YAG, QS ruby, QS alex
White	Titanium dioxide, zinc oxide	QS Nd:YAG (532)
Fitzpatrick IV-VI		QS Nd:YAG ONLY!!!

Tattoos

- Amateur tattoos
  - 4-6 treatments
- Professional tattoos
  - >8 treatments
- Anesthesia
  - Topical or intralesional
- Clinical endpoint: Tissue Whitening
- Bleeding or epidermal disruption
  - Need to lower fluence
- Subsequent treatments: need higher fluence

III. Laser Hair Removal

- Chromophore – melanin in the hair shaft
- Biological target – stem cells in the bulge and bulb area
  - Distance separation betwee
- Ideally need longer pulse durations (extended theory of photothermolysis) than TRT of the melanin
- Cannot treat blonde, grey or white hair
  - Attempts to insert exogenous chromophore

Laser Hair Removal

- Long pulsed ruby (694)
- Long pulsed alexandrite (755)
  - e.g. GentleLASE
- Diode Laser (800 nm)
  - eg. LightSheer
- QS Nd:YAG (1064nm)
  - Best for darker skin (IV-VI), less effective for long term hair removal
- IPL
  - Cut-off filters to remove short wavelengths

IV. Laser Resurfacing

- **Chromophore: Water**

IV. Laser Resurfacing

- **Ablative**
  - CO_2 (10,600 nm), Er:YAG (2940 nm), YSGG (2790 nm)
- N**on-Ablative**
  - Vascular lasers (532, 585-595)
  - ii) mid-IR lasers (1320 Nd:YAG, 1450 diode, 1540 Er:glass)
  - iii) IPL
  - iv) RF
- **Fractional Resurfacing**

Fractional Laser Resurfacing

- Treats only a fraction of skin surface in a given session
  - Faster wound healing and reduced downtime
  - Greater penetration
  - Generally safer on darker skin types
- Fractional Non-Ablative
  - Fraxel Restore 1550; Lux 1540
- Fractional Ablative
  - Er:YAG, YSGG (Pearl),
  - CO_2 (Fraxel Repair, Smart Xide Dot, Active FX)

Fat removal

- **Invasive**
  - Gold standard
  - Liposuction (general or tumescent anesthesia)
  - +/- Laser (Smart/Prolipo) or Ultrasound (Vaser)
- **Non-invasive**
  - Faster recovery
  - Decreased risk of side effects
  - No surgery
  - Limitations regarding efficacy

Non-Invasive Body Contouring

- **Ultrasound**
  - Thermal, focused
    - Liposonix (Valeant)
  - Non-thermal, focused
    - Ultrashape (Syneron)
  - Nonfocused
    - Bella Contour (Real Aesthetics)
- **Cryolypolysis**
  - Coolsculpting (Zeltiq)
- **RF**
  - Exilis (BTL Industries)
  - truSculpt (Cutera)
  - *Thermage (Solta) – will not discuss today*
- **Low Level Light Therapy**
  - Zerona (Erchonia Medical)

Body Contouring

- Jury is still out!
- Lots of devices
  - Some work, some don't

PEARLs

- New treatments for photoaging
  - Safe and effective
  - Botox, fillers, cosmeceuticals
- Lasers
  - Selective photothermolysis
  - Multiple indications