Hands-on: Lasers

NonAblative Rejuvenation

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DISCLOSURE OF RELEVANT RELATIONSHIPS WITH INDUSTRY

DISCLOSURES

Allergan: Advisory Board

Cutera: Consultant
NonAblative

- Induce a dermal healing response
  - Sparring injury to the epidermis
  - MOA:
    - induces a wound repair response
    - fibroblast stimulation
    - collagen reformation.
NonAblative Skin Rejuvenation

Bolognia Dermatology

Table 137.7 -- Lasers and other devices used for rejuvenation and resurfacing.

<table>
<thead>
<tr>
<th>Laser/device</th>
<th>Target</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-ablative</strong></td>
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<tr>
<td>Vascular lasers (532 nm pulsed KTP, 585 and 595 nm pulsed dye)</td>
<td>Dermal vasculature</td>
<td>Excellent safety, no recovery time, improvement in telangiectasias</td>
<td>Minimal efficacy, multiple treatments necessary</td>
</tr>
<tr>
<td>Near-infrared lasers (1310 nm diode, 1320 nm long-pulsed Nd:YAG, 1450 nm diode, 1540 nm Er:glass) and light devices (1100–1800 nm)</td>
<td>Dermal collagen and water</td>
<td>Excellent safety, no recovery time, greater efficacy for rhytides</td>
<td>Modest efficacy, multiple treatments necessary</td>
</tr>
<tr>
<td>Intense pulsed light source</td>
<td>Dermal vasculature, pigment, collagen and water</td>
<td>Moderate safety, no recovery time, improvement in telangiectasias and dyspigmentation</td>
<td>Minimal to modest efficacy, multiple treatments necessary</td>
</tr>
<tr>
<td>Radiofrequency energy source</td>
<td>Dermal collagen; dermal and subcutaneous charged particles and water</td>
<td>Excellent safety, no recovery time, greater efficacy for rhytides and laxity</td>
<td>Modest efficacy, multiple treatments necessary</td>
</tr>
<tr>
<td><strong>Fractional</strong></td>
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<tr>
<td>Fractionated lasers (1320/1440 nm Nd:YAG; 1410, 1540 and 1550 nm erbium-doped fiber; 2940 nm erbium: YAG; 10 600 nm carbon dioxide) and light devices (825–1350 nm)</td>
<td>Water</td>
<td>Greater efficacy than non-ablative modalities for rhytides, also improves dyspigmentation</td>
<td>Moderate efficacy, 2–3 day recovery time, multiple treatments necessary (but fewer than non-ablative modalities)</td>
</tr>
<tr>
<td>Laser type</td>
<td>Wavelength (nm)</td>
<td>Fluences (J/cm²)</td>
<td>Pulse duration</td>
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<tr>
<td>---------------</td>
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</tr>
<tr>
<td>KTP (pulsed)</td>
<td>532</td>
<td>7–15</td>
<td>20–50 ms</td>
</tr>
<tr>
<td>PDL</td>
<td>585</td>
<td>3–6.5</td>
<td>350, 450 µs</td>
</tr>
<tr>
<td></td>
<td>595</td>
<td>6–12</td>
<td>6–10 ms</td>
</tr>
<tr>
<td>IPL</td>
<td>550–1200</td>
<td>25–28</td>
<td>2.4, 4.0 ms</td>
</tr>
<tr>
<td>Nd:YAG</td>
<td>1320</td>
<td>17–22</td>
<td>200 or 350 µs</td>
</tr>
<tr>
<td>Nd:YAG (QS)</td>
<td>1064</td>
<td>2.5–7</td>
<td>5 ns</td>
</tr>
<tr>
<td>Diode</td>
<td>1450</td>
<td>8–14</td>
<td>160–260 ms</td>
</tr>
<tr>
<td>Er:glass</td>
<td>1540</td>
<td>Up to 126</td>
<td>3.3</td>
</tr>
<tr>
<td>Infrared light</td>
<td>1100–1800</td>
<td>30–40</td>
<td>170–200 pulses</td>
</tr>
</tbody>
</table>

**Radiofrequency**

- RF, monopolar
- RF bipolar current
- RF bipolar current

For pain:

- RF, bipolar radiation

For RF:

- RF bipolar current

- RF bipolar current

IP: 1.0, 1.5, 3 cm

RF: radiofrequency; QS, Q-switched; PDL, pulsed dye laser.
Liu et al.

Collagen I production is predominantly increased after non-ablative treatment with the pulse dye laser (PDL), 1320 nm neodymium:yttrium aluminum garnet (Nd:YAG) laser, and the long pulsed 1064 nm Nd:YAG laser.

Collagen type III was more significantly increased in those treated with the Q-switched 1064 nm Nd:YAG laser.

Selective Photothermolysis
Vascular Lasers

- Indications
  - telangiectasias
  - diffuse facial erythema (erythematotelangiectatic rosacea)
  - hemangiomas
  - PWS
  - leg veins (telangiectasias, venulectasias, reticular veins)

- Chromophore = oxyhemoglobin

- Extended photothermolysis
  - Larger, heterogeneous targets (ie blood vessels) may need pulses longer than the thermal relaxation time
  - Goal IS heat conduction to surrounding tissues (blood vessel wall damage)
Vascular Lasers

- **Oxyhemoglobin absorption**
  - Peaks at 418, 518, 577nm
  - Band at 800-1000nm

- **PDL (585 or 595nm) most commonly used**
  - Works well for superficial vessels, but limited for deeper vessels

- **KTP (Potassium-titdnyl-phosphate) 532nm**
  - Limited use bc shorter wavelength
    - Decreased penetration
    - Decreased risk of purpura b/c use longer pulse durations
    - Increased risk of melanin absorption

- **Nd:YAG**
  - 532 nm-double frequency, half wavelength – uses KTP crystal
  - 1064 nm works well for deeper vessels

- **Others:**
  - Argon 488-514 nm
  - Krypton 568 nm
  - Copper vapor/bromide 578 nm
  - Alexandrite 755 nm
  - Diode 800-900-nm
  - iPL with filters
Vascular lasers

- Remember:
  - Stacking pulses can increase efficacy
    - Whitening or blister formation can occur with pulse stacking or high fluence
  - Smaller pulse duration $\rightarrow$ increased risk of purpura, but increased efficacy (same energy delivered over less time)
    - Pulse width 10ms or more avoids purpura
  - Aftercare
    - Cold compresses immediately after treatment help edema and erythema
    - Sunscreen for 4 weeks after treatment
Intense Pulsed Light

- Targeting UV induced changes
- Goldberg et al.
- Improvement noted at 6-month follow-up in the quality of the skin in 25 of 30 (83%) patients who were treated with an IPL source with a 645-nm cutoff filter.
- Blistering occurred in 3 out of 30 (10%)
Fractional Photothermolysis

- Heats tissue in “microthermal zones” or MTZs
- ~ 15-25% surface area treated
Non-ablative lasers

- Mechanism: photothermal dermal effects without damaging epidermis
  - Collagen contraction and neocollagenesis
- Less dramatic effect
- Fewer side effects and less downtime than ablative
- Used for rhytids and scars in series of 3+ monthly tx

Infrared spectrum
- Nd:YAG 1064 nm and 1320 nm
- Diode 980 and 1450nm
- Er:glass 1540nm
- IPL 500-1200 nm
Skin Types I - III

**Non-Ablative:**

- IPL
- Q-Switched
- Pulsed Dye
- KTP
- Radio Frequency

Infrared

- $\mu$sec
- Long pulsed
- Fractional
Skin Types IV - VI

**Non-Ablative:**

KTP

Radio Frequency

Infrared

- $\mu$sec
- Long pulsed
- Fractional
Photoaging and Nonablative Photorejuvenation in Ethnic Skin

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BACKGROUND. Advances in nonablative skin rejuvenation technologies have sparked a renewed interest in the cosmetic treatment of aging skin. More options exist now than ever before for reversing cutaneous changes caused by long-term exposure to sunlight. Although Caucasian skin is more prone to ultraviolet light injury, ethnic skin (typically classified as types IV to VI) also exhibits characteristic photoaging changes. Widespread belief that inevitable or irreversible textural changes or dyspigmentation occurs following laser- or light-based treatments has been challenged in recent years by new classes of devices capable of protecting the epidermis from injury during treatment. Demographic changes in the US population favor an increasing trend of older, ethnically diverse patients requesting treatment to recapture a youthful appearance.

OBJECTIVE. The purpose of this article is to review the recent literature regarding clinical recognition and treatment of photoaging changes in ethnic skin. This article provides a basis for classification of current and future nonablative technologies with regard to the safety and efficacy of treatment in ethnic skin.

CONCLUSIONS. Nonablative technologies have emerged to meet the public demand for no-downtime treatment of aging skin. As these technologies continue to evolve and improve, physicians are challenged to define realistic goals, expectations, and limitations for treatment. Whenever possible, ongoing and future studies should attempt to address treatment in ethnic skin types. Photoaging changes in ethnic skin can be recognized and successfully treated with nonablative technology with minimal risk and downtime.
Fractional non-ablative

- Improvement in newer devices
  - Increased energy delivered, greater depth of penetration (therefore tissue effect)
  - Increasing density will increase clinical effect

- Superior results in facial skin rather than neck, chest
  - Facial rhytids, atrophic scars, large pores
  - Melasma- mixed results

- Fractional diode 1410 nm

- Fractional Nd:YAG 1440 nm, 1440/1320 nm,

- Er:glass 1540 nm

- Fractional erbium-doped fiber 1550 nm “Fraxel Re:Store”

- Fractional thulium fiber 1927

- New laser 1565 nm with no disposable tips

- New laser 1940 thulium:alexandrite
On the horizon: New targets, new wavelengths

- Sebaceous glands involved in sebaceous hyperplasia and acne/rosacea
  - PDT and IPL have been used
  - Novel 1720 nm laser effective in sebaceous hyperplasia without damaging surrounding skin