Melanin Absorption

Absorption coefficient, 1/cm

Wavelength, nm

Alex
Diode
Nd:YAG

700 750 800 850 900 950 1000 1050 1100
Approx. pulse settings needed to achieve preset fluence for Lumenis

Peak power, kW  1.6  
Spot size 2.2x3.5, cm²

<table>
<thead>
<tr>
<th>Set fluence J/cm²</th>
<th>Req. pulse, ms</th>
</tr>
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<tbody>
<tr>
<td>6</td>
<td>28.9</td>
</tr>
<tr>
<td>8</td>
<td>38.5</td>
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<tr>
<td>10</td>
<td>48.1</td>
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<tr>
<td>12</td>
<td>57.8</td>
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<tr>
<td>14</td>
<td>67.4</td>
</tr>
<tr>
<td>16</td>
<td>77.0</td>
</tr>
<tr>
<td>18</td>
<td>86.6</td>
</tr>
<tr>
<td>20</td>
<td>96.3</td>
</tr>
</tbody>
</table>

Calculations show that to achieve a fluence of 12J/cm², the required pulse duration is 58ms
Hair follicle target temperatures

Example: 12J/cm², 60ms treatment has equivalent treatment efficacy to

6J/cm², 20ms in 100µm hair shaft OR 7.4J/cm², 20ms in 200µm bulb

>> 8J/cm², 20ms can be used with reduced pain and better efficacy

Lumenis requires 60ms pulse to get 12J/cm²

Cynosure has pulse width independent of fluence so 20ms can be used (more effective temp rise)
• Greatest reduction seen with Alexandrite laser at 70.3% and combination of Alexandrite and Nd:YAG laser at 67.1%

• The long pulse diode laser was less efficacious at 59.7%

Clinical proof for Alex and Nd:YAG vs. Diode

Comparative Evaluation of Long-Pulse Alexandrite and Long-Pulse Nd:YAG Laser Systems Used Individually and in Combination for Axillary Hair Removal
Jane G. Ricker, MD,* Ramandeep Sareen, MD,* and Miriam F. Goldman, MD**

BACKGROUND: The 755-nm alexandrite and the 1,064-nm Nd:YAG lasers are both utilized for hair removal. Advances in laser technology have led to the development of dual-wavelength treatment for increased efficacy.

OBJECTIVE: The objective was to evaluate the safety and efficacy of combining 755- and 1,064-nm wavelengths for axillary hair removal.

METHODS: Twenty patients received three treatments at 4- to 6-week intervals in four axillary quadrants. The left upper axilla was treated with the alexandrite laser, the left lower axilla with the Nd:YAG laser, the right upper axilla with combination alexandrite and Nd:YAG laser, and the right lower quadrant with the diode laser. At 1- and 2-month follow-up visits, subjects completed questionnaires and were assessed for percentage of hair reduction.

RESULTS: Eighteen subjects completed the study. The greatest reduction was seen with the alexandrite laser at 76.7% and combination of alexandrite and Nd:YAG laser at 67.1%. The diode laser was less effective at 69.7%, and the Nd:YAG laser had the least improvement with 47.4% reduction. Subjects found the alexandrite and diode lasers to be the most tolerable and the Nd:YAG and combination treatment to be the most painful.

CONCLUSION: Combination treatment of alexandrite and Nd:YAG lasers provides no added benefit over the alexandrite laser alone. The Alexandrite Laser used in this study was owned by Cynosure.

Laser hair removal is a well-established treatment modality for the reduction of unwanted hair. Based on the theory of selective photothermolysis, several hair removal laser systems have been developed.1 Because of their wavelengths and extended pulse durations, the 755-nm alexandrite, 1,064-nm diode, and 1,064-nm Nd:YAG lasers have been shown to be effective in photoregression.2-4 While many studies have been published that document the safety and efficacy of these laser systems, only two studies exist to date that directly compare these three wavelengths for hair removal.2,5 Rao and Goldman6 in their study explored the benefits of combining these three wavelengths on improvement of hair reduction. However, to the best of our knowledge no study to date has explored the benefits of combining wavelengths for increased efficacy of laser hair removal.

Recently, the emerging trend of multiwavelength lasers has led several companies to offer a 755-nm alexandrite and a 1,064-nm Nd:YAG laser in one unit. The 1,064-nm Nd:YAG wavelength is better suited for removing hair from dark skin, but may not provide the most effective treatment for lighter hair. The 755-nm alexandrite wavelength can treat darker hair and is more effective than the 1,064-nm wavelength in treating lighter hair but is not ideal for darker skin. A new laser system capable of emitting 755- and 1,064-nm wavelengths simultaneously may increase efficacy in treating a wider variety of skin and hair types.

*Department of Dermatological Laser Associates, La Jolla Spa MD, La Jolla, California
**2011 by the American Society for Dermatologic Surgery, Inc. Published by Blackwell Publishing
Pili bigemini can be induced by intermediate doses of diode laser energy

Kaniowska J Cosmetic Derm 2004 3 104-6

- Pili bigemini – appearance of two hairs coming from the same follicular opening

- The incidence of double hairs coming from a single follicle after two therapies may have been caused by the use of a too low fluence which induced hair follicles instead of destroying them

- Regrowing hairs were clearly thinner, lighter and fewer
• Long term hair removal requires damage to one or more growth centers of hair.

• New hairs may evolve from the dermal papilla, follicular matrix or the bulge (3-7mm deep in the skin).

• Due to this skin depth, significant energies must be applied for effective hair removal.

• Significant hair loss only at sites treated with the highest fluences.

• With diode, clinically obvious long-term hair reduction usually required greater or equal to 30J/cm2.

• Treatment with the diode laser also showed reduction in hair diameter (19.9% reduced diameter) and color (lighter and thinner).
“Terminalization” is the conversion of vellus hairs to terminal hair (thick pigmented hairs)

We observed “terminalization” mainly in patients who were treated with low fluences

We hypothesize that produced heat is less than the temperature necessary for thermolysis of the hair follicle

The heat shock may induce follicular stem cell differentiation and growth via increasing the level of heat shock proteins (HSP 27) in the tissue
Hair Growth Induced by Diode Laser Treatment

Bernstein Dermatol Surg 2005;31:584-586

- Dramatic case of hair growth following treatment with 810nm diode laser
- Reduction in hair on posterior neck approx 25% post 3 TX
- Test spot on back had a dramatic increase in hair growth
- Three treatments cleared the area of hair growth but an annulus of hair appeared surrounding the treated area
- See images on next slide
Hair Growth Induced by Diode Laser Treatment

*Bernstein Dermatol Surg 2005;31:584-586*

**Figure 1.** Hair growth 14 weeks following an 810 nm diode laser treatment to a rectangular test patch on the upper back.

**Figure 2.** An annulus of hair growth surrounding the test patch shown in Figure 1 16 weeks following three diode laser treatments to this abnormal patch of hair growth.
• Regrowing hair is typically thinner and lighter in color

• The efficacy for hair removal increases with increasing treatment fluence

<table>
<thead>
<tr>
<th>TABLE 4. HAIR REDUCTION RESULTS</th>
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<tbody>
<tr>
<td>Fluence</td>
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<tr>
<td></td>
</tr>
<tr>
<td>5 ms, 15 J/cm²</td>
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<tr>
<td>10 ms, 20 J/cm²</td>
</tr>
<tr>
<td>15 ms, 30 J/cm²</td>
</tr>
<tr>
<td>20 ms, 40 J/cm²</td>
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<tr>
<td>20 ms, 40 J/cm² 3x</td>
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<tr>
<td>20 ms, 40 J/cm² 3x 3x</td>
</tr>
<tr>
<td>20 ms, 40 J/cm² 3x</td>
</tr>
<tr>
<td>Control</td>
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</tbody>
</table>

*Percentage is not statistically significant.
• Just 5.5% of treatments were done with fluences <20 J/cm²
• The most frequently used fluence was between 25-29 J/cm²
• This requires use of the smaller 9x9mm handpiece (the 22x35mm handpiece is limited to 12J/cm²)
• The 9x9mm handpiece utilizes contact cooling which requires frequent cleaning to remove contamination and debris.
Efficacy of hair removal has been shown to be superior with a 12mm spot size vs. 8mm spot size.

No improvement seen at sizes beyond 12mm.

Coverage comparison
1 minute treatment

Elite 18mm Handpiece

18mm spot
10% overlap
265 cm² covered
2Hz

Lumenis 22x35mm Handpiece

22x35mm spot
30% overlap
255 cm² covered
1Hz (time required for pneumatic action)

Example: 5’9” male back area of 2628cm² would take 10 minutes with Elite and 10.3 minutes with Lightsheer
Other considerations

- Elite MPX offers clinically proven epidermal protection using air cooling (no contact). The Lightsheer Duet offers contact cooling (requires frequent cleaning) or vacuum suction (will not work well with bony/small areas – limited to back of legs and back).

- Elite MPX is a multiple application workstation – leg veins, facial veins, pigmented lesions (with IPL), laser facial.

- Lightweight and ergonomic handpieces that allow full view of treatment area. The Lightsheer Duet has a heavy and bulky handpiece. Vision of the treatment site is not possible.

- The diode array is within the Lightsheer handpiece so if the handpiece is dropped this can be extremely expensive to replace.

- Elite MPX offers multiple handpieces which are very quickly changed over (3, 5, 7, 10, 12, 15 and 18mm) enabling treatment of smaller areas (on face) and larger areas (back) to everything in between. The Lightsheer Duet offers just 2 options 9x9 (lengthens procedure time considerably for legs/back) or 22x35mm (too large for face/bikini area and limited to just 12J/cm²).

- Elite MPX 15 and 18mm spot sizes provide for a very quick procedure. The Lightsheer handpiece requires 30% overlap in one direction and 50% in the other. Combined with the constant need to clean the suction plate, the handpiece is not as efficient as the size would suggest.
Blinded, Bilateral Hair Removal Study Comparing the Alexandrite Laser with MPX Mode

Preliminary Results

6 subject subset

Investigator: E. Bernstein
Hair Removal Study Clinical Comparison of Preliminary Results

• **Elite MPX**
  - 76% – 79% reduction 1 month post 2 TX
    - Average reduction by Alex: 76%
    - Average reduction by Alex/YAG: 78%
    - Average reduction by YAG/Alex: 76%

• **Alexandrite laser (Cynosure 510k data)**
  - 76% reduction post 15 months, post 3-5 TX

• **Nd:YAG (Alster/Tanzi, Derm Surg, 2004)**
  - 58%-69% reduction post 1 month post 3 TX
  - 41% -53% reduction post 6 months post 3TX

Industry standard to determine clearance or reduction of hair follicles is:

6 months post last TX
Subject 03

Alex/YAG

Before

After just 2 treatments

Alex
Subject 03

Before

Alex/YAG

d = 23.275 hairs/cm²

After just 2 treatments

Alex

d = 5.042 hairs/cm²

d = 20.022 hairs/cm²

d = 5.906 hairs/cm²
Subject 07

Before

After just 2 treatments

Alex/YAG

Alex
Subject 07

Alex/YAG

Before

d = 14.668 hairs/cm²

After just 2 treatments

d = 2.852 hairs/cm²

Alex

Before

d = 13.293 hairs/cm²

After just 2 treatments

d = 2.903 hairs/cm²
Subject 16

Before | After just 2 treatments
---|---
YAG/Alex
Alex

Before
After just 2 treatments

YAG/Alex
Alex
Subject 16

YAG/Alex

Before

d= 12.367 hairs/cm²

After just 2 treatments

d= 2.088 hairs/cm²

d= 14.515 hairs/cm²

d= 2.597 hairs/cm²
Subject 20

Before | After just 2 treatments

YAG/Alex

Alex
Subject 20

YAG/Alex

Before

After just 2 treatments

d = 14.821 hairs/cm²

d = 3.820 hairs/cm²

Alex

Before

After just 2 treatments

d = 13.700 hairs/cm²

d = 3.769 hairs/cm²
Hair Removal Study Clinical Comparison of Results

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