Comparison of Fractional Er:YAG and CO$_2$ Lasers in Resurfacing of Atrophic Scars in Asians

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One family, together
Disclosure

- Research grant and equipment loan
  - Fotona dd (Slovenia)
  - Lumenis Inc (USA)
  - Syneron Medical Ltd (Israel)
  - Pollgen (Israel)
  - Laser Engineer (Thailand)
Milestone of laser resurfacing

1995 Ablative

Ablative CO$_2$ Resurfacing: Downtime
Hyperpigmentation: Skin type IV
Milestone of laser resurfacing

1995 Ablative

1997 Nonablative
Milestone of laser resurfacing

1995: Ablative

1997: Nonablative

2002: Fractional resurfacing

Fractional Resurfacing

• Technique which only a fraction of the skin is treated
  • Faster wound healing
  • Shorter downtime
  • Lesser side effects

<table>
<thead>
<tr>
<th>Classification</th>
<th>Nonablative</th>
<th>Ablative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Erbium fiber</td>
<td>• CO₂</td>
</tr>
<tr>
<td></td>
<td>• Er glass</td>
<td>• Erbium:YAG</td>
</tr>
<tr>
<td></td>
<td>• Nd:YAG</td>
<td>• YSGG</td>
</tr>
<tr>
<td></td>
<td>• IPL powered laser</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• IPL powered infrared</td>
<td></td>
</tr>
</tbody>
</table>

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Classification of fractional resurfacing

**Nonablation**
- Erbium fiber
- Er glass
- Nd:YAG
- IPL powered laser
- IPL powered infrared

**Ablative**
- CO₂
- Erbium:YAG
- YSGG
Fractional CO$_2$ laser resurfacing in White

Treatment of acneiform scarring: Skin type II

Before After 3 Tx

What about in dark-skinned patient?

Efficacy and safety of a carbon-dioxide ablative fractional resurfacing device for treatment of atrophic acne scars in Asians

Wongpiphak Duangsai, MD, Emmanuel Iyenger, MD, K. Georgios Myatra, MD, and Kangkara Wannapaiboonvorakul, MD

Bangkok, Thailand

Ablative laser resurfacing (ALR) using standard, pulsed carbon-dioxide (CO2) and fractional carbon-dioxide ablative lasers has been proven effective for treatment of acne scars. However, the threshold of ablation for patients with darker skin types (melanin index 5-7) is not well reported. This study evaluated the efficacy and safety of a new fractional ablative CO2 (FA-CO2) laser (Analytic Medical Systems, Inc., Carlsbad, CA) on atrophic acne scars among Asian patients (22-42 years old, Fitzpatrick type IV). A total of 33 men and 27 women were treated with seven to 12 FA-CO2 laser sessions at two-week intervals. Ablative doses were determined based on pre-treatment skin analysis. Baseline pictures were taken by a validated software program. Based on a blinded dermatologist assessment, FA-CO2 CO2 laser treatments (1.55J and 2.05J) were more effective than standard CO2 laser treatments (5.05J) for Fitzpatrick type IV skin. The mean improvement of atrophic acne scars in the analyses was 15.6%. The FA-CO2 laser treatment group showed significantly better improvement at 6 weeks post-treatment, with a mean improvement of 26.7% (P = 0.01). The FA-CO2 laser treatment was well tolerated and no serious adverse events occurred. This study suggests that the FA-CO2 laser treatment is a promising treatment option for atrophic acne scars in patients with Fitzpatrick type IV skin.

References

Key messages

• PIH remains the most common side effect found in dark-skinned patient.

• Improvement of FP can be observed up to 6 months after Tx
## Adverse effects

<table>
<thead>
<tr>
<th>Adverse effect</th>
<th>No. of affected pt/Total no. of pt</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIH</td>
<td>12/13 (92.3%)</td>
</tr>
<tr>
<td>Acneiform eruption</td>
<td>4/13 (30.8%)</td>
</tr>
<tr>
<td>Contact dermatitis</td>
<td>2/13 (15.4%)</td>
</tr>
<tr>
<td>HSV infection</td>
<td>1/13 (7.7%)</td>
</tr>
</tbody>
</table>
## Risk of PIH

<table>
<thead>
<tr>
<th>Report source</th>
<th>Skin type</th>
<th>Incidence of PIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldman MP et al. <em>ASDS Annual Meeting 2008, USA</em></td>
<td>I-III</td>
<td>0%</td>
</tr>
<tr>
<td>Gold MH et al. <em>J Drugs Dermatol 2008;7:774-7</em></td>
<td>IV-V</td>
<td>0%</td>
</tr>
<tr>
<td>Manuskiatti W et al. <em>J Am Acad Dermatol 2010;63:274-83</em></td>
<td>IV</td>
<td>92%</td>
</tr>
</tbody>
</table>
Pre-operation

6th week

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Pre-operation

8th week

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Spectrum of Fractional Resurfacing

Superficial Fractional Ablative Resurfacing
(CO2 & 2.94 Erb:YAG)
10-70 microns

Non-Ablative Fractional Resurfacing
600-1000 microns

Ablative Fractional Resurfacing
600-1000 microns
Comparison of Fractional Erbium: YAG and Carbon Dioxide Lasers in Resurfacing of atrophic scars in Asians

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Thanawan Iamphonrat, M.D.
Sasima Eimpunth, M.D.
Rungsima Wanitphakdeedecha, M.D.
Methods

Er:YAG laser (Fotona dd, Slovenia)

Parameter
- Fluence: 14 mJ
- Pulse duration: 350 µsec
- 5% coverage

CO₂ laser (Lumenis, USA)

Parameter
- Fluence: 10-15 mJ
- Pulse duration: 950 µsec
- 5% coverage
Histologic Study

- **Interventions:**
  - A/C: Er:YAG laser
  - B/D: CO₂ laser
  - E: untreated control

- **Timing**
  - A/B: 3-mo before Sx
  - C/D: immediate before Sx
## Depth of ablation + coagulation

<table>
<thead>
<tr>
<th>Laser/injury</th>
<th>MTZ Diameter (µm)</th>
<th>Vaporization depth (µm)</th>
<th>Coagulation depth (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Er:YAG</td>
<td>120</td>
<td>65</td>
<td>100</td>
</tr>
<tr>
<td>CO₂</td>
<td>160</td>
<td>160</td>
<td>350</td>
</tr>
</tbody>
</table>
Tissue effect after CO$_2$ laser

CO$_2$ Laser

Laser

Vaporization/Ablation

Coagulation

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Histologic study

Er:YAG Laser

CO₂ Laser

100 µm

350 µm
Histologic Study

Control 3 Months after Er:YAG Laser

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Histologic Study

Control  3 Months after CO$_2$ Laser

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Method

- 24 subjects received 2 Tx at 2-mo interval
- EMLA cream was applied 1 hr prior to Tx
- No prophylactic antibiotic or antiviral was used
- Petrolatum jelly was applied post-op qid for 7 d
Evaluations

- Evaluations were done at
  - Month 1, 3 and 6 after the last (2nd) Tx
- Assessments include
  - Photograph evaluation by 2 blinded dermatologists
  - Patient self-assessment
  - Scar volume measurement using UVA-light camera
  - Adverse effects
Results

- 20/24 patients completed the study
- Mean age: 29 (20-51)
- Female/Male: 12/8
- All patients were skin type IV
Physician Evaluation

Month 1

% of patients

- Er:YAG
- CO2
Physician Evaluation

Month 3

Month 6
Patient Evaluation

Month 6

% of Patients

0%  1-25%  26-50%  51-75%  >75%

Er:YAG  CO2

Month 6
## Pain score

0 = no pain, 10 = excruciating pain

<table>
<thead>
<tr>
<th>Laser/Tx#</th>
<th>Er:YAG</th>
<th>CO₂</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx I</td>
<td>3.5</td>
<td>6.2</td>
<td>0.001</td>
</tr>
<tr>
<td>Tx II</td>
<td>2.9</td>
<td>5.4</td>
<td>&lt;0.001</td>
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</tbody>
</table>
### Post inflammatory hyperpigmentation (PIH)

<table>
<thead>
<tr>
<th>Laser</th>
<th>Er:YAG (%)</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per #subject (N=20)</td>
<td>7/20 (35%)</td>
<td>10/20 (50%)</td>
</tr>
</tbody>
</table>
# Hours of pain persistence

<table>
<thead>
<tr>
<th>Laser/ hr of pain</th>
<th>Er:YAG</th>
<th>CO₂</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.1 hours</td>
<td>4.0 hours</td>
<td>0.68</td>
</tr>
</tbody>
</table>
#days for clearing of crust

<table>
<thead>
<tr>
<th>Laser</th>
<th>Er:YAG</th>
<th>CO₂</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>#days</td>
<td>3.6</td>
<td>3.3</td>
<td>0.72</td>
</tr>
</tbody>
</table>
### days for clearing of redness

<table>
<thead>
<tr>
<th>Laser</th>
<th>Er:YAG</th>
<th>CO₂</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>#days</td>
<td>3.75</td>
<td>4.0</td>
<td>0.92</td>
</tr>
</tbody>
</table>
Fractional Er: YAG

Before

1 mo after Tx II

3 mo after Tx II

6 mo after Tx II
Fractional CO$_2$

Before

1 mo after Tx II

3 mo after Tx II

6 mo after Tx II
Fractional Er: YAG

Before

1 mo after Tx II

3 mo after Tx II

6 mo after Tx II
Conclusion

- As of 6-mo F/U, fractional Er: YAG and CO\textsubscript{2} lasers showed comparable cosmetic improvement.
- Fractional CO\textsubscript{2} laser was associated with:
  - higher degree of pain
  - higher incidence of PIH
Thank you for your attention

true success is not in the learning, but
in its application to the benefit of mankind

M. Soroush

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