TwinLight Rejuvenation: Past – Present - Future

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The Skin Doctors’ Center - Trieste
BACKGROUND

World population live longer. People tend to be physically and socially active for much longer time. Most people want to look younger in spite of their age.

Most people do not want to face long post-op down-time, intra- and post-op pain, major side effects and potential complications when thinking about rejuvenation procedures.
Isolated body areas are PERMANENTLY or MORE SELECTIVELY exposed to UV radiations inducing structural, functional and chromatic modifications described as photo-aging.

In these areas skin aging is progressing MORE RAPIDLY than other non UV exposed parts of the body due to complex biological interaction of chrono- and photo-aging.
<table>
<thead>
<tr>
<th></th>
<th><strong>Intrinsic ageing</strong></th>
<th><strong>Extrinsic ageing</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epidermis</strong></td>
<td>Normal keratinization, thin, flaccid, atrophy of the basal layer</td>
<td>Hypertrophy and heterogeneity of the horny layer, acanthosis in the early stages,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>numerous abnormal mitotic cells in the basal layer</td>
</tr>
<tr>
<td><strong>Dermoeipidermal</strong></td>
<td>Shortening of the dermoeipidermal adhesion region, smoothening of the rete pegs</td>
<td>Flattening of the rete pegs, thickening of the lamina densa</td>
</tr>
<tr>
<td><strong>Dermis</strong></td>
<td>Damaged architecture of the matrix fibres, impaired elastic fibres, decrease in</td>
<td>Senile elastosis – fibres, accumulation of pathological elastic fibres, presence of</td>
</tr>
<tr>
<td></td>
<td>number of collagen fibres</td>
<td>perivenular inflammatory cells</td>
</tr>
</tbody>
</table>
Looking Older
Fibroblast Collapse and Therapeutic Implications

Gary J. Fisher, PhD; James Varani, PhD; John J. Voorhees, MD

Thus, type I collagen in human skin is very stable, requiring approximately 30 years on average to undergo replacement.
Looking Older

Fibroblast Collapse and Therapeutic Implications

Gary J. Fisher, PhD; James Varani, PhD; John J. Voorhees, MD

Thus, the slow accumulation of cross-linked collagen fragments that occurs during the aging process compromises the structural integrity of the collagenous matrix and creates an environment in which fibroblasts lose mechanical tension (ie, collapse) and produce less collagen and more MMPs. Once initiated, this shift in balance toward net collagen degradation is self-perpetuating and never ending, leading to the thin, fragile, collagen-deficient skin observed in elderly persons.
Looking Older

Fibroblast Collapse and Therapeutic Implications

Gary J. Fisher, PhD; James Varani, PhD; John J. Voorhees, MD

Figure 3. Mechanical stretch induced by dermal injection of cross-linked hyaluronic acid filler (CLHA) stimulates collagen production in photodamaged human skin (original magnification × 400 for both panels). Saline vehicle (A) (control) or CLHA (B) was injected into photodamaged forearm skin. Skin biopsy specimens were obtained 4 weeks after injection and analyzed for type I procollagen expression by immunohistochemical analysis. A, Fibroblasts (nuclei stained blue with hematoxylin-eosin) in saline-injected skin display barely detectable procollagen expression (stained red with 3-amino-9-ethylcarbazol [AEC] chromagen stain). Also note amorphous space and fragmented thin appearance of collagen extracellular matrix. B, In CLHA-injected skin, fibroblasts display intense red type I procollagen immunostaining (AEC chromagen stain). The CLHA appears as light blue material (hematoxylin-eosin) (black arrows) that occupies space (asterisk) adjacent to stretched fibroblasts (white arrows). Note also densely packed collagen fibrils (black daggers) not seen in the saline-injected skin of panel A. These dense collagen fibrils are likely derived from CLHA-induced type I procollagen (i.e., conversion of type I procollagen into type I collagen).
Aging is a natural process common to all living entities.

Genetic Factors

Environmental Factors

TIME

UV
SMOKING
POLLUTION
FOOD
ACCIDENTS

RACES

Photo-Aging

Environmental-Aging
Different Skin Types react Differently to Exogenous Agents

Fitzpatrick Skin Phototype Scale (1975-published 1988)
4+2 point scale useful to determine skin response to UV exposure

Kawada Skin Phototype Scale (1986)
scale useful to determine skin reaction to UV exposure in Japanese skin

Glogau Skin Aging Scale (1994)
4 point scale useful to determine visual perception of photo-aging

Lancer Ethnicity Scale (1998)
scale based on ancestry and skin reaction to UV exposure

Goldman World Classification of Skin Types (2002)
scale useful to determine skin reaction to UV exposure (tanning) and burning (post-inflammatory hyperpigmentation)

Willis & Earles Skin Scale (2005)
scale based skin reaction to UV exposure in african descent subjects

Taylor Hyperpigmentation Scale (2006)
visual scale based on laminated cards (10-15 hues and 100 gradation of skin colour

Baumann Skin Scale Solution (2006)
scale based on 16 common skin types to select proper skin care techniques for consumers

Roberts Hyperpigmentation Response Scale
6 point scale based on post-inflammatory hyperpigmentation reactivity

Roberts Scar Response Scale
5 point scale based on post-injury scarring reactivity
### Ethnic Skin Types Identified in the U.S.

Source: US Census Bureau

<table>
<thead>
<tr>
<th></th>
<th>Races</th>
<th>Racial subtypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>2000</td>
<td>6</td>
<td>67</td>
</tr>
</tbody>
</table>
### Fitzpatrick’s Classification of Facial Wrinkling (Perioral and Periorbital)

<table>
<thead>
<tr>
<th>Class</th>
<th>Score</th>
<th>Wrinkling</th>
<th>Degree of Elastosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1–3</td>
<td>Fine wrinkles</td>
<td>Mild (fine textural changes with subtly accentuated skin lines)</td>
</tr>
<tr>
<td>II</td>
<td>4–6</td>
<td>Fine to moderate depth wrinkles, moderate number of lines</td>
<td>Moderate (distinct papular elastosis, individual papules with yellow translucency, dyschromia)</td>
</tr>
<tr>
<td>III</td>
<td>7–9</td>
<td>Fine to deep wrinkles, numerous lines, with or without redundant skin</td>
<td>Severe (multipapular and confluent elastosis, thickened yellow and pallid cutis rhomboidalis)</td>
</tr>
</tbody>
</table>

### Hamilton’s Classification of Contour Changes of Facial Skin

<table>
<thead>
<tr>
<th>Facial Aging</th>
<th>Clinical Morphology</th>
<th>Tissue Location</th>
<th>Clinical Location</th>
<th>Etiology</th>
<th>Optimal Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Folds</td>
<td>Muscular</td>
<td>Nasolabial folds, neck, eyelids</td>
<td>Loss of tone, gravity</td>
<td>Rhytidectomy, blepharoplasty</td>
</tr>
<tr>
<td>B</td>
<td>Furrows</td>
<td>Musculo-cutaneous</td>
<td>Forehead, smile lines</td>
<td>Repeated facial expressions</td>
<td>Filler substances, injectables, implants</td>
</tr>
<tr>
<td>C</td>
<td>Wrinkles</td>
<td>Cutaneous</td>
<td>Checks, crow’s feet, perioral</td>
<td>Intrinsic aging, photaging</td>
<td>Resurfacing, laser, chemical peel</td>
</tr>
<tr>
<td>D</td>
<td>Combination</td>
<td></td>
<td></td>
<td></td>
<td>Combined approach</td>
</tr>
</tbody>
</table>

A Classification of Facial Wrinkles

Gotfried Lemperle, M.D., Ph.D., Ralph E. Holmes, M.D., Steven R. Cohen, M.D., and Stefan M. Lemperle, M.D.

San Diego, Calif.

Masked Observer
Defect Classification
1 Month Post-Treatment

Refer to the Treatment Diagram for treated areas

Masked Observer Name:  
Masked Observer Signature:  
Date:  

Neck Folds

0  
1  
2  
3  
4  
5

PLASTIC AND RECONSTRUCTIVE SURGERY, November 2001
## Comprehensive Facial Aging Grading Scales modified from Alexiades-Armenakas 2006

<table>
<thead>
<tr>
<th>S</th>
<th>DP</th>
<th>W</th>
<th>L</th>
<th>E</th>
<th>D</th>
<th>E-T</th>
<th>K</th>
<th>TX</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>1</td>
<td>mild</td>
<td>+ in motion superficial</td>
<td>N-L folds</td>
<td>minimal yellow hue</td>
<td>1-3 lentigines &gt;5mm</td>
<td>pink E or few T single site</td>
<td>few</td>
<td>subtle irregularity</td>
</tr>
<tr>
<td>1.5</td>
<td>mild</td>
<td>++ in motion superficial</td>
<td>N-L folds &amp; + ML folds</td>
<td>yellow hue+ periorbital</td>
<td>3-6 lentigines &gt;5mm</td>
<td>pink E or few T 2 sites</td>
<td>several</td>
<td>mild irregularities few areas</td>
</tr>
<tr>
<td>2</td>
<td>moderate</td>
<td>+ at rest superficial</td>
<td>N-L &amp; ML &amp; + SMe SMa</td>
<td>yellow hue++ periorbital</td>
<td>7-10 lentigines &gt;5mm</td>
<td>red E or multiple T 2 sites</td>
<td>multiple small</td>
<td>rough in few areas</td>
</tr>
<tr>
<td>2.5</td>
<td>moderate</td>
<td>++ at rest superficial</td>
<td>++N-L jowels+SMe</td>
<td>yellow hue++ periorbital + malar</td>
<td>multiple small and isolated large lentigines</td>
<td>red E or multiple T 3 sites</td>
<td>multiple large</td>
<td>rough in several areas</td>
</tr>
<tr>
<td>3</td>
<td>advanced</td>
<td>+++ at rest superficial</td>
<td>++++N-L jowels+SMe</td>
<td>yellow hue++ periorbital + malar + other</td>
<td>many small and large lentigines</td>
<td>violaceous E or multiple T multiple sites</td>
<td>many</td>
<td>rough in multiple areas</td>
</tr>
<tr>
<td>3.5</td>
<td>advanced</td>
<td>++++ at rest superficial</td>
<td>+++++N-L jowels+SMe</td>
<td>yellow hue++++ periorbital + malar + other</td>
<td>&gt;20 small and large lentigines ++uninvolved</td>
<td>violaceous E &amp; multiple T multiple sites</td>
<td>little uninvolved skin</td>
<td>mostly rough little uninvolved skin</td>
</tr>
<tr>
<td>4</td>
<td>severe</td>
<td>++++ at rest deep</td>
<td>+++++NL jowels+SMe</td>
<td>yellow hue++ face++ comedones</td>
<td>extensive small and large lentigines</td>
<td>violaceous E &amp; diffuse T full face</td>
<td>no uninvolved skin</td>
<td>rough skin full face</td>
</tr>
</tbody>
</table>

**DP:** Descriptive Parameters  
**W:** Wrinkles  
**L:** Laxity  
**E:** Elastosis  
**D:** Dyschromia  
**E-T:** Erythema - Telangiectasias  
**K:** Keratoses  
**E:** Texture
The effects of skin colour distribution and topography cues on the perception of female facial age and health

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† Department of Sociobiology/Anthropology, Institute of Zoology & Anthropology, University of Göttingen, Göttingen, Germany
‡ P & G Beauty, Rusham Park Technical Centre, Whitehall Lane, Egham, Surrey, UK

Abstract

According to evolutionary psychology, the preference for some facial characteristics reflects adaptations for mate choice because they signal aspects of mate quality. Although morphological features such as facial symmetry and sexually dimorphic traits have been studied extensively in recent years, little is known about skin condition in this context. The preferences for young and healthy looking skin could offer an explanation as to why women place such an importance on the condition of their skin and its refinement through e.g., cosmetic products. Recent research showed that facial skin colour distribution significantly influences the perception of age and attractiveness of female faces, independent of skin surface topography cues. However, the relative effect of skin colour distribution and topography cues on age and health perception remains to be investigated. We present data showing that both skin colour distribution and skin surface topography cues not only significantly influence the perception of female facial age and health but also convey differential information with regard to the strength of these effects. Our data indicate that skin surface topography cues account for a large proportion of variation in facial age perception, whereas skin colour distribution seems to be a stronger health cue.
Influence of facial skin attributes on the perceived age of Caucasian women

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† INSERM, U678, Paris, France
‡ Université Pierre et Marie Curie-Paris 6, UMR U678 Paris, France
§ Johnson & Johnson Consumer France SAS, Skin Care Research Institute, Issy-les-Moulineaux, France
‖ Laboratoire LSIS (UMR CNRS 6168) – Equipe I & M (ESIL), Case 925-163, Marseille cedex 9, France

Results The eye area and the skin colour uniformity were the main attributes related to perceived age. For age prediction, older graders’ estimations were more driven by lips border definition shape and eyes opening, whereas younger graders’ (older than 50 years) estimations were more driven by dark circles, nasolabial fold and brown spots.

There were statistically significant differences in graders’ age perception between gender and among age ranges. Our findings suggest that female graders are more accurate than male, and younger graders (under 35 years) are more accurate than older (over 50 years) to predict Caucasian women age from facial photographs.

Conclusions Different skin attributes influence the estimation of age. These attributes have a different weight in the evaluation of the perceived age, depending on the age and of the observer. The most important attributes to estimate age are eyes, lips and skin colour uniformity.
OBJECTIVE

We wanted to find an **effective rejuvenation strategy** taking advantage of photo-thermal effects of **two specific laser wavelengths** used sequentially on the same target: a non ablative IR (1064nm Nd:YAG) and a highly water-selective ablative fractional 2940nm Er:YAG.

In order to find a **positive compromise** between effective clinical results and Patient Acceptability Parameters (PAP), laser settings were clinically studied until the objective was achieved. Research started in 2008.

**ORIGIN**

**FOTONA SP-PLUS**
- Er:YAG laser
- Pixel Fractional Handpiece PS-01
- Stamp Fractional Handpiece PS-02

**EVOLUTION**

**FOTONA DYNAMIS XS**
- Er:YAG laser
- F-Runner Fractional Scanner
# Laser Photo-Thermal Tissue Effects

<table>
<thead>
<tr>
<th>Biological Effects</th>
<th>Action</th>
<th>Clinical Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destructive</td>
<td>ablative</td>
<td>Immediate intra-op perception</td>
</tr>
<tr>
<td></td>
<td>non ablative</td>
<td>Late post-op perception</td>
</tr>
<tr>
<td>Destructive &amp; Regenerative</td>
<td>ablative</td>
<td>Immediate intra-op + late post-op perception</td>
</tr>
<tr>
<td></td>
<td>non ablative</td>
<td></td>
</tr>
<tr>
<td>Regenerative</td>
<td>non ablative</td>
<td>Very late post-op perception</td>
</tr>
</tbody>
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## LIGHT TISSUE DELIVERY COMBINATIONS

<table>
<thead>
<tr>
<th>ISD - Immediate Sequential Delivery</th>
<th>DSD - Delayed Sequential Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Target Time-limited Light-Tissue Interaction</td>
<td>Multi-Target Time-unlimited Light-Tissue Interaction</td>
</tr>
<tr>
<td>Immediate Light Layering Technique (LLT)</td>
<td>Delayed Light Layering Technique (LLT)</td>
</tr>
<tr>
<td>Complex non-modifiable immediate Photo-Thermal Effect</td>
<td>Complex modifiable delayed Photo-Thermal Effect</td>
</tr>
<tr>
<td>Complex non-modifiable delayed Photo-Biological Effect</td>
<td>Complex modifiable delayed Photo-Biological Effect</td>
</tr>
<tr>
<td>System and/or Factory pre-set</td>
<td>Physician choice</td>
</tr>
</tbody>
</table>
SPF-RR SEQUENTIAL PHOTO-THERMAL FRACTIONAL RESURFACING AND REMODELING TWINLIGHT REJUVENATION

FRACTIONAL ABLATIVE TISSUE REMODELING + RESURFACING

ENLARGED CORE PHOTO-THERMAL BULK HEATING

1064nm Nd:YAG with scanner @ 3mm spot – 0.3 ms pulsewidth - 26Hz – 35J/cm²

1064nm Nd:YAG with scanner @ 3mm spot – 35 ms pulsewidth - 7Hz – 50J/cm²

2940nm fractional Er:YAG + chilled air cooling – 75/450 µm microspots – 600µsec pulsewidth - 7 mm focused handpiece - 10Hz – 3.9J/cm² or 250 µm microspots F-Runner Fractional scanner 5-10% coverage 12J/cm² 50Hz
Case: 65 years old female: Chrono- and Photo-aging associated with AK and superficial BCC

Sequential Photo-Thermal Fractional Resurfacing and Remodeling (SPF-RR)

TwinLight Rejuvenation

Immediately post-op  
30 min post-op  
5 days post-op  
30 days post-op
RATIONALE

Short and Long pulse 1094nm Nd:YAG laser provides a scanner-assisted, controlled full thickness photo-thermal skin warming able to “prime” dermal fibroblast, triggering these cells to produce neo-collagen as well as extracellular MMP, extremely important to eliminate old, broken collagen fibers. Temperatures above 44°C induce HSP production by all involved cells leading to positive effects on apoptotic “cleaning” of malfunctioning or previously damaged cells.

Fractional 2940nm Er:YAG laser offers a highly controlled epidermal + superficial dermal photo-vaporization quite effective to reduce total number of UV-damaged keratinocytes (potential neoplastic clones) and extremely important to trigger dermal fibroblast activity through keratinocyte-specific cytokines.

TwinLight laser rejuvenation produce positive synergistic photo-thermal effects on treated tissue
Patient treated with **SPF-RR TwinLight rejuvenation** confirmed the efficacy of the procedure as well as predicted post-op down-time and minor intra-operative and post-operative discomfort.

All treated Patients accepted to be enrolled in a personalized skin rejuvenation programme featuring 1-2 **TwinLight rejuvenation** procedures per year

Observed positive clinical outcome on the vast majority of our Patients convinced us to publish our study in the **JCLT**
SPF-RR sequential photothermal fractional resurfacing and remodeling with the variable pulse Er:YAG laser and scanner-assisted Nd:YAG laser

LEONARDO MARINI

SDC – The Skin Doctors’ Center, Trieste, Italy

Table IX. SPF-RR treatment parameters.

<table>
<thead>
<tr>
<th></th>
<th>Laser</th>
<th>Spot</th>
<th>Pulse</th>
<th>Fluence</th>
<th>Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st pass</td>
<td>Nd:YAG</td>
<td>3 mm</td>
<td>0.3 ms</td>
<td>35 J/cm²</td>
<td>26</td>
</tr>
<tr>
<td>2nd pass</td>
<td>Nd:YAG</td>
<td>3 mm</td>
<td>35 ms</td>
<td>50 J/cm²</td>
<td>7</td>
</tr>
<tr>
<td>3rd pass</td>
<td>Er:YAG</td>
<td>7 mm</td>
<td>LP 600 µs</td>
<td>3.9 J/cm²</td>
<td>5</td>
</tr>
<tr>
<td>4th pass</td>
<td>Er:YAG</td>
<td>7 mm</td>
<td>LP 600 µs</td>
<td>3.9 J/cm²</td>
<td>5</td>
</tr>
</tbody>
</table>
Sequential Photo-thermal Fractional Resurfacing and Remodeling (SPF-RR)

Pre-op

Post-op +90 days

Post-op +180 days

Pre-op

Post-op +90 days

Pre-op

Post-op +90 days

Twin-Light Rejuvenation
PRESENT STUDIES

To further investigate the biological effects of SPF-RR TwinLight rejuvenation two studies were conducted.

A clinical-histologic evaluation on 100 cases

A histologic evaluation of each sequential step of our combined laser procedure versus SPF-RR TwinLight rejuvenation complete laser sequence on 10 cases
## STUDY GROUPS

<table>
<thead>
<tr>
<th>Group A: 1094nm (x2) + F 2940nm (x2)</th>
<th>Group B: 2940nm (x2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPF-RR Laser Layering Technique</td>
<td>Double sequential pass technique</td>
</tr>
<tr>
<td>TwinLight Rejuvenation</td>
<td>SingleLight Rejuvenation</td>
</tr>
<tr>
<td>55 Pt – 38-60yrs (mean 45)</td>
<td>45 Pt – 40-62yrs (mean 48)</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; pass: 1064nm 0.3ms 35J/cm² 3mm</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; pass 2940nm 0.6ms 12J/cm² 0.25mm</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; pass: 1064nm 35ms 50J/cm² 3mm</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; pass 2940nm 0.6ms 12J/cm² 0.25mm</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; pass: 2940nm 0.6ms 12J/cm² 0.25mm</td>
<td></td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; pass: 2940nm 0.6ms 12J/cm² 0.25mm</td>
<td>Clinical Photographs T0-T30-T60-T90</td>
</tr>
<tr>
<td>Clinical Photographs T0-T30-T60-T90</td>
<td>3mm punch BX (pre-auricular – 12 Pt)</td>
</tr>
<tr>
<td>3mm punch BX (pre-auricular – 15 Pt)</td>
<td>Standard EE histology (D+30; D+90)</td>
</tr>
<tr>
<td>Standard EE histology (D+30; D+90)</td>
<td>Pt clinical diary</td>
</tr>
<tr>
<td>Pt clinical diary</td>
<td></td>
</tr>
</tbody>
</table>
Clinical Photographs T0-T30-T60-T90 Blind Evaluation Procedure

1. Master Researcher renominated all case photographs converting Pt identification “A” into “X” and “B” into “Y”

2. Two Dermatologists evaluated independently all clinical pictures assigning the difference in % in:
   a. overall skin appearance;
   b. epidermal dispigmentation;
   c. rhytides;
   d. skin laxity

Histologic Evaluation Procedure

3. All surgical specimens were cut perpendicularly to blue marking (unTX side) before being processed with standard EE stain. All slides were analyzed by a single blinded dermatopathologist for Tx-induced changes
Group A: 1094nm + 2940nm - Pt # 03

3mm Punch
pre-auricular crease

Standard 3mm punch BX

Blue marking: untreated side

90 days post TX
TX side
unTX side

30 days TX side
90 days TX side
Group B: 2940nm - Pt # 08

30 days TX side

90 days TX side

90 days post TX

Standard 3mm punch BX

Blue marking: untreated side
**Group A: 1094nm (x 2) + Fractional 2940nm (x 2)**

**T+90**
- Overall skin appearance: 62% improvement
- Epidermal dispersion: 50% improvement
- Rhytides: 21% improvement
- Skin laxity: 35% improvement

Pt # 03A 44 y.o.
Group A: 1094nm (x 2) + Fractional 2940nm (x 2)

T+90
Overall skin appearance: 52% improvement
Epidermal dispigmentation: 30% improvement
Rhytides: 10% improvement
Skin laxity: 37% improvement

Pt # 45A 38 y.o.
Group B: Fractional 2940nm (x 2)

T+90
Overall skin appearance: 24% improvement
Epidermal dispigmentation: 10% improvement
Rhytides: 15% improvement
Skin laxity: 18% improvement

Pt # 15B 40 y.o.
RESULTS (I)

Blind Photographs Evaluation

Concordance between two evaluators: 90%
Overall skin appearance: 37% higher at T+90 in Group A
Epidermal dispigmentation: 25% higher at T+90 in Group A
Rhytides: 35% higher at T+90 in Group A
Skin laxity: 38% higher at T+90 in Group A

Blind Dermatopathology Evaluation

Collagen fibers positive rearrangement: 32% higher at T+90 in Group A
Flattening of rete ridges: 20% higher at T+90 in Group A
Epidermal thickness positive rearrangement: 30% higher at T+90 in Group A

Medical Assessment

Group A: 1094nm (x2) + F 2940nm (x2) TwinLight Rejuvenation
Group B: 2940nm (x2)
RESULTS (II)

Patient Assessment

Procedure acceptability rate

Group A: 85%
Group B: 87%

Subjective perception of overall clinical improvement at T+90

Group A: 78%
Group B: 62%

All Patients confirmed their willingness to repeat both types of procedures to maintain the improvements they achieved

Group A: 1094nm (x2) + F 2940nm (x2) TwinLight Rejuvenation
Group B: 2940nm (x2)
Sequential Photo-Thermal 1064nm Nd:YAG and 2940nm Er:YAG Fractional Resurfacing and Remodeling (TwinLight Rejuvenation) has proven to be superior to 2940nm Er:YAG Fractional Resurfacing alone both clinically and histologically.

More studies are needed to assess the clinical effects of different sequences of laser wavelengths according to what could be described as Laser Layering Technique (LLT).
HISTOLOGIC STUDY on 3 SINGLE and 1 LASER LAYERING PROCEDURES

10 Fitzpatrick II-III subjects (6M-4F 48-56 y.o. mean 52)

Clinical findings: mild photoaging and brachial skin laxity (brachioplasty)

Four 4mm punch BX (T-0) and four 4mm punch BX (T+60) on four tattoo outlined laser TX areas

E.E.; Masson Trichrome; Type 1 procollagen AB

Photo-micrographs @ scanning and 10X magnification

RESULTS

Laser TX-A (short pulse 1064nm Nd:YAG): T-0 moderate edema; T+60 type1 procollagen AB moderately increased + positive rearrangement of collagen fibres

Laser TX-B (long pulse 1064nm Nd:YAG): T-0 minimal edema; T+60 no significant modifications

Laser TX-C (fractional 2940nm Er:YAG x 2): T-0 microvaporization zones (MVZ) reaching papillary dermis; T+60 type1 procollagen AB minimally increased + positive rearrangement of collagen fibres

Laser TX-D (TX-A + TX-B + TX-C sequential layering): T-0 significant edema + MVZ; T+60 type1 procollagen AB significantly increased + positive rearrangement of collagen fibres
HISTOLOGIC STUDY on 3 SINGLE and 1 LASER LAYERING PROCEDURES

**BX1 – T0**
TXA: 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted

**BX2 – T0**
TXB: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted

**BX3 – T0**
TXC: 2940nm Er:YAG 0.175ms @ 6J/cm² 250μ spot 50Hz stackingX2– scanner assisted

**BX4 – T0**
TXD: TXA + (followed by) TXB + (followed by) TXC – Twin-Laser Rejuvenation

**BX5 – T+60**
TXA: 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted

**BX6 – T+60**
TXB: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted

**BX7 – T+60**
TXC: 2940nm Er:YAG 0.175ms @ 6J/cm² 250μ spot 50Hz stackingX2– scanner assisted

**BX8 – T+60**
TXD: TXA + (followed by) TXB + (followed by) TXC – Twin-Laser Rejuvenation
Max 2094nm Er:YAG tested scanner size

14mm x 14mm \( \times 4 \)  

28mm x 30mm \( \times 2 \)

**T-30:** tattoo marking of selected TX areas (28mm x 30mm)

**T-0:** TX + 4mm punch BX (HE + Masson Trichrome + Procollagen Type1 AB)

**T+60:** 4 mm punch BX (HE + Masson Trichrome + Procollagen Type1 AB)
T-30 PRE-TX PREPARATION – #4 TX AREAS TATTOO MARKING (I)

- tattoo marking
T-30 PRE-TX PREPARATION – # 4 TX AREAS TATTOO MARKING (II)

- Standardized pre-tattoo marking template
- Light tattooing
- Polyurethane film dressing
- Tattoo @ 60 days
- Immediate post-op T-O
T-0 - #4 LASER PROCEDURES - #4 PUNCH BX

1064nm Nd:YAG

2940nm Er:YAG

Post-Op

4mm punch

T+60 - #4 PUNCH BX
No TX

medial arm skin

TX

No TX

TX

T0

T+60

Blue marking to identify no TX area

Specimen cutting perpendicular to blue marking

HE – Hematoxylin – Eosin
MT – Masson Trichrome
T1pc AB – Type1 procollagen antibody

Pz # 02 BX1 S HE

Pz # 02 BX1 S MT

Pz # 02 BX1 S T1pc AB

S – Scanning magnification
**TX-A:** 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted

**S** – Scanning magnification
**Pz # 02**

**TX-A:** 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted
Pz # 02 BX2 S HE
S – Scanning magnification

**TX-B**: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted
TX-B: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted
**TX-C:** 2940nm Er:YAG 0.175ms @ 6J/cm² 250μ spot 50Hz stackingX2– scanner

S – Scanning magnification
TX-C: 2940nm Er:YAG 0.175ms @ 6J/cm² 250µ spot 50Hz stackingX2– scanner
TX-D: TX-A + (followed by) TX-B + (followed by) TX-C
TX-D: TX-A + (followed by) TX-B + (followed by) TX-C

1. **TX-A**: 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted
2. **TX-B**: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted
3. **TX-C**: 2940nm Er:YAG 0.175ms @ 6J/cm² 250µm spot 50Hz stackingX2 – scanner
TX-A: 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted

Pz # 02 BX5 S HE
S – Scanning magnification
TX-A: 1064nm Nd:YAG 0.3ms @ 35J/cm² 3mm spot – scanner assisted
TX-B: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted
TX-B: 1064nm Nd:YAG 35ms @ 50J/cm² 3mm spot – scanner assisted
**TX-C:** 2940nm Er:YAG 0.175ms @6J/cm² 250μ spot 50Hz stackingX2–scanner assisted

S – Scanning magnification
TX-C: 2940nm Er:YAG 0.175ms @6J/cm2 250μ spot 50Hz stackingX2–scanner assisted
TX-D: TX-A + (followed by) TX-B + (followed by) TX-C
TX-D: TXA + (followed by) TX-B + (followed by) TX-C
Sequential Laser Layering Technique combining two different wavelengths: 1064 nm Nd:YAG and 2940nm Er:YAG (**Twin-Laser Rejuvenation – Tx-D**) has proven **superior to single laser treatments** with: a. 1064 Nd:YAG short pulse (Tx-A); b. 1064nm Nd:YAG long pulse (Tx-B); and 2940nm Er:YAG fractional mode photo-ablation (Tx-C)
TWIN LIGHT REJUVENATION - 1064nm Nd:YAG + 2940nm Er:YAG
THE FUTURE
ACTIVES + LIGHT PHOTO-BIOLOGICAL EFFECTS

Photosensitizers

Antiangiogenic agents

Chemical peels

PRP – PPP - PRGF

Drugs

- PDT
- PWS + vascular alterations
- Antiaging
- Regenerative + Antiaging
- Topically Delivered Therapy

B before  A after
Fractional-Peel
2940nm Er:YAG fractional laser + 15-20% TCA Peel
Potentiation of Photodynamic Therapy by Heat: Effect of Sequence and Time Interval Between Treatments In Vivo

Stephen M. Waldow, PhD, Barbara W. Henderson, PhD, and Thomas J. Dougherty, PhD

Division of Radiation Biology, Department of Radiation Medicine, Roswell Park Memorial Institute, Buffalo, New York

When 44.5°C for 30 min was applied immediately after PDT (15 min), significant potentiation was seen (58% tumor control vs 3 and 10% for PDT and heat, respectively) (Fig. 1). This potentiation decreased with increasing time interval between PDT and heat, with tumor control values decreasing to 36, 20, and 14%, when 2, 4, and 8 hr, respectively, were allowed between treatments. Little if any potentiation (above an additive effect) was seen when 44.5°C for 30 min was applied 0–8 hr before the 15-min PDT treatment. An essentially additive effect of the independent therapies was also seen when this heat treatment was given immediately before a 30-min PDT treatment (48% tumor control vs 33 and 10% for PDT and heat, respectively) (Table I). In comparison, greater potentiation was again seen when this heat treatment was given immediately after the same 30-min PDT treatment (76% tumor control vs 33% [PDT] and 10% [heat]) (Table I).
Potentiation of Photodynamic Therapy by Heat: Effect of Sequence and Time Interval Between Treatments In Vivo

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In principle, the simultaneous or sequential application of heat and light can be carried out by higher power density at 630 nm for smaller tumors or by use of a more penetrating heat source such as a Nd-Yag laser at 1,060 nm. Each can be conveniently delivered via fiber optics from readily available sources. The attenuation of 630-nm light through tissue is 2 to 3 times greater than that for 1,060-nm radiation [20]. Thus, for tumors or other tissues greater than a few millimeters in thickness, the Nd-Yag laser may be the preferred heat source.
Fractional CO₂ Laser-Assisted Drug Delivery

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Conclusions: Ablative fractional laser treatment facilitates delivery of topical MAL deeply into the skin. For the conditions of this study, laser channels approximately 3 mm apart followed by MAL application could produce porphyrins throughout essentially the entire skin. AFR appears to be a clinically practical means for enhancing uptake of MAL, a photodynamic therapy drug, and presumably many other topical skin medications. Lasers Surg. Med. 42:113–122, 2010. © 2009 Wiley-Liss, Inc.

Key words: fractional ablative resurfacing; photodynamic therapy; photosensitizer; topical drugs
Laser Assisted Delivery of Topical Anesthesia for Intramuscular Needle Insertion in Adults

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Key words: Er:YAG laser; laser ablation; lidocaine; pain; stratum corneum
Topical Delivery of Methotrexate Via Skin Pretreated With Physical Enhancement Techniques: Low-Fluence Erbium:YAG Laser and Electroporation

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Results: Application of the laser and electroporation significantly enhanced the permeation of MTX. The enhancing effect was more pronounced after applying the laser. Er:YAG laser pretreatment on the skin produced a 3- to 80-fold enhancement dependent upon the magnitude of the laser fluence. Using electroporation, treatment with 10 pulses resulted in a twofold increase in MTX flux. A combination of laser pretreatment and subsequent electroporation for 10 minutes resulted in a higher drug permeation than either technique alone. However, this synergistic effect was only observed when the lower laser fluence (1.4 J/cm²) was applied. Hyperproliferative skin generally showed a greater variability of MTX flux and lower permeation.


Key words: methotrexate; topical delivery; Er:YAG laser; electroporation; hyperproliferation
Laser Treatments on Skin Enhancing and Controlling Transdermal Delivery of 5-Fluorouracil

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Background and Objective: Laser ablation of stratum corneum (SC) enhances transdermal delivery of hydrophilic drugs. The influence of the infrared (IR) (λ = 1,064 nm), visible (λ = 532 nm), and ultraviolet (UV) (λ = 355 nm) radiations of a Nd:YAG laser on transdermal delivery of 5-Fluorouracil (5-Fu) across skin was studied in vitro.

Case: 40 y.o. female: Photo-aging associated with AK and superficial BCC

**1064nm Nd:YAG laser**
1st pass: 3mm 0.3ms 30J/cm² - scanner
2nd pass: 3mm 35ms 50J/cm² - scanner

**2940nm Er:YAG laser**
3rd pass: 240μm fractional 6J/cm² 20Hz stacking #2

**5-10% Liposome-Encapsulated 5-ALA** – 2 hr occlusion

**633 nm LED Time-Splitted irradiation** (4’ - 30’ pause - 16’)

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Thermo-Fractional PDT

Pre-op  | Post-op +90 days | Pre-op  | Post-op +90 days
Evolution of **LED sources**
Thermo-Fractional PDT is a painful procedure!

Full face nerve block anaesthesia is absolutely necessary

Post-op pain peaks @ 24-48hr and prominent swelling is usually observed
TWO FRACTIONAL LASER SYSTEMS STUDIED AS CUTANEOUS PENETRATION ENHANCERS

Fotona Dynamis XS
F-Runner 2940nm Er-YAG scanner

DEKA SmartXside Dot
10600nm CO₂ scanner
Combined Laser-induced Thermo-Therapy and **2940nm Er:YAG** Fractional Skin Penetration Enhancement associated with Topical 10% Liposome 5-ALA (Thermo-Fractional PDT)

1. 1064nm Nd:YAG
2. 2940nm Er:YAG/10600 CO₂
3. pre-10% 5-ALA application
4. occlusive dressing – 6 hrs
5. 635nm LED irradiation
5 yrs old persistent HPV  
90 days post advanced PDT (2 sessions)

3 yrs old persistent HPV  
90 days post advanced PDT (1 session)
Combined Laser-induced Thermo-Therapy and **2940nm Er:YAG** Fractional Skin Penetration Enhancement associated with Topical 10% Liposome 5-ALA (ThermoFractional PDT)

2 yrs old persistent HPV

7 days post advanced PDT (1 session)

90 days post advanced PDT (1 session)
In Conclusion:

Combining different Energy Sources offers the advantage of improving clinical results and reduces possible complications/side effects proper of each Energy Source pushed to its limits when used alone to attempt achieving comparable results.

Modern Laser and Energy Sources technology allows easier and more reproducible results – combining them sequentially is an art and requires deep knowledge of each system used as well as proper treatment strategies tailored to specific skin types and problems.

The future of Light Treatments is incredibly bright and will provide Physicians and Patients amazing satisfactions.
THANK YOU
FOR YOUR ATTENTION

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