Innovative Low Fluence-High Repetition Rate Technology for Hair Removal

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Alma Lasers®
Wellbeing Through Technology®

SOPRANO XL

Virtually Painless Laser Hair Removal

Alma Lasers®

Wellbeing Through Technology®

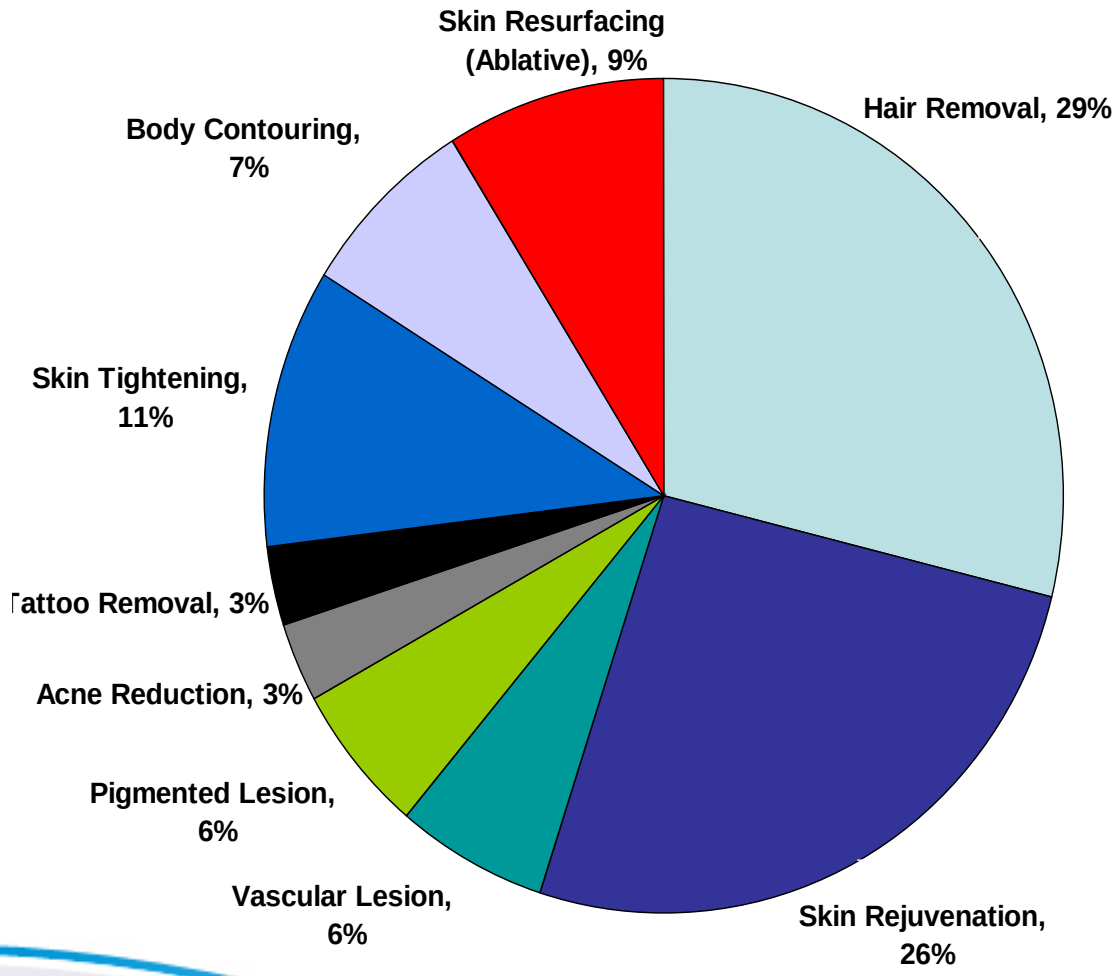
Terms

LHR = laser hair removal

SHR = super hair removal

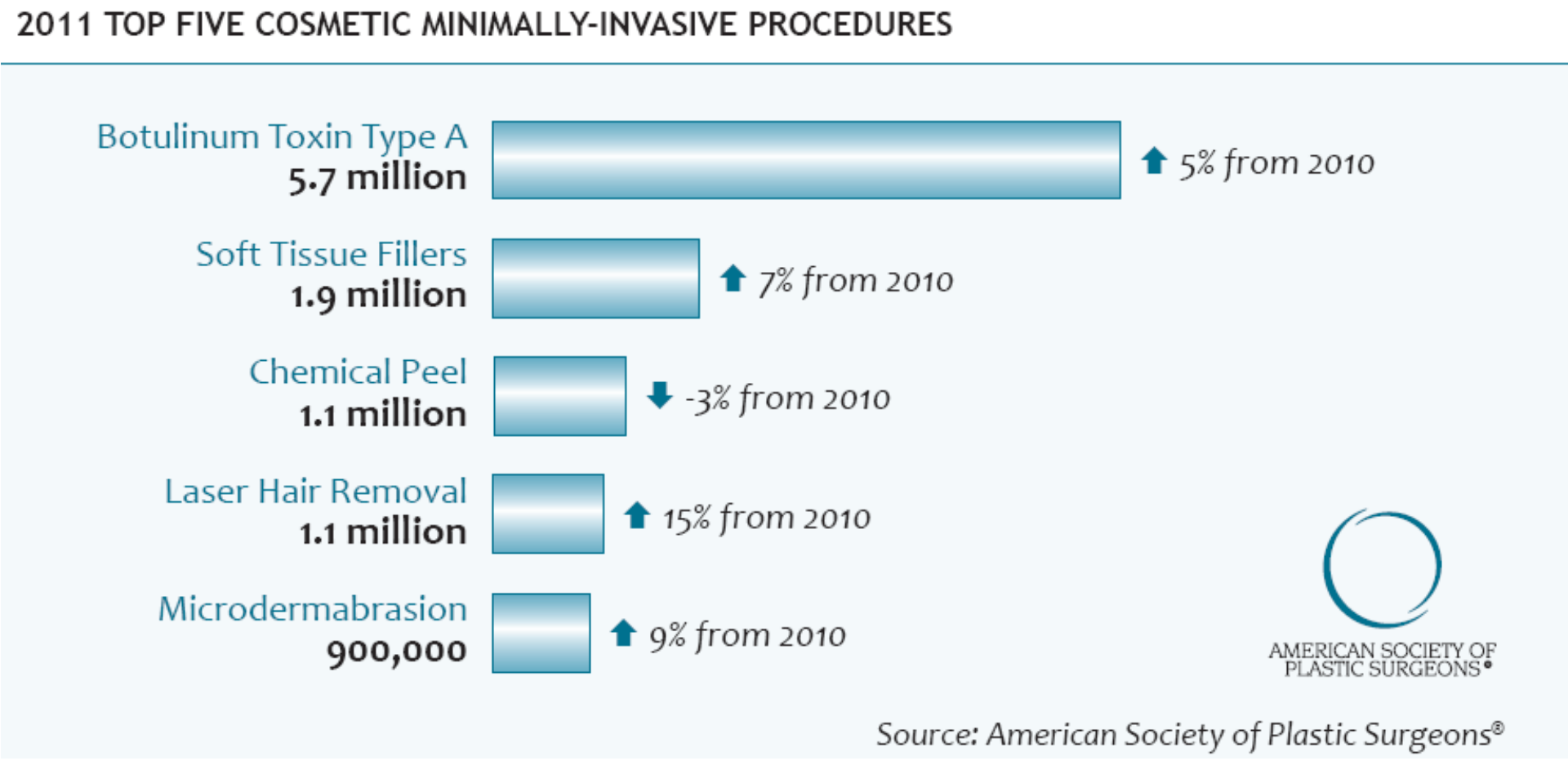
Introduction

Global Aesthetic Laser Market



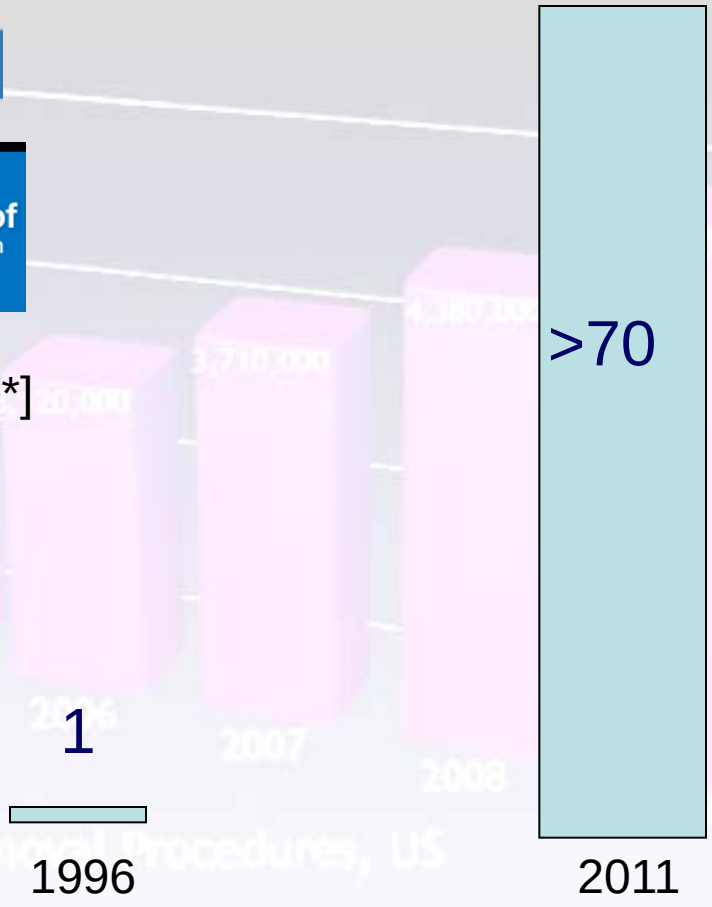
Source: Frost & Sullivan 2005, Millennium Research Group, 2006, Med Insight, 2006.

Growth of Laser Hair Removal

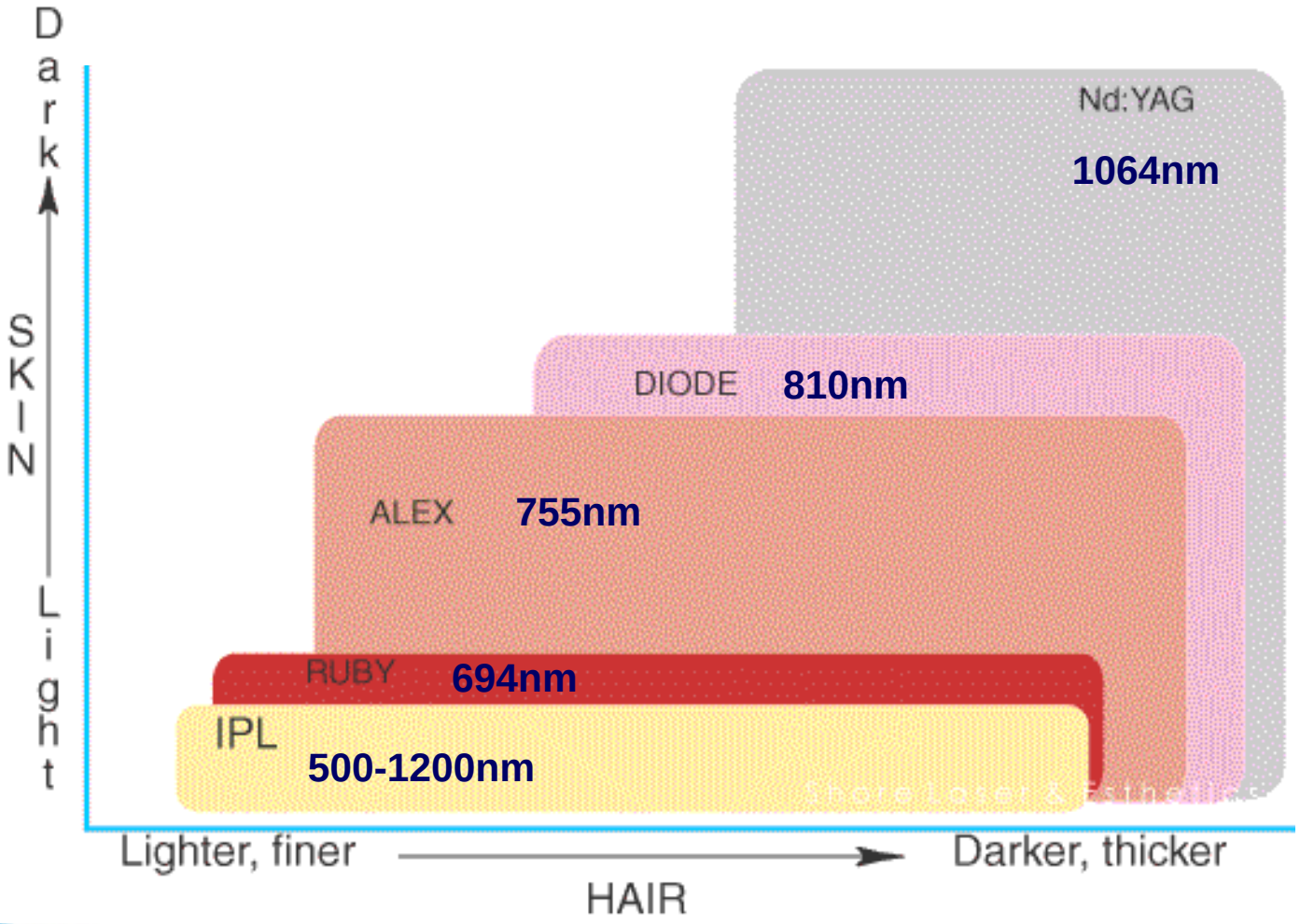


LHR Publications*

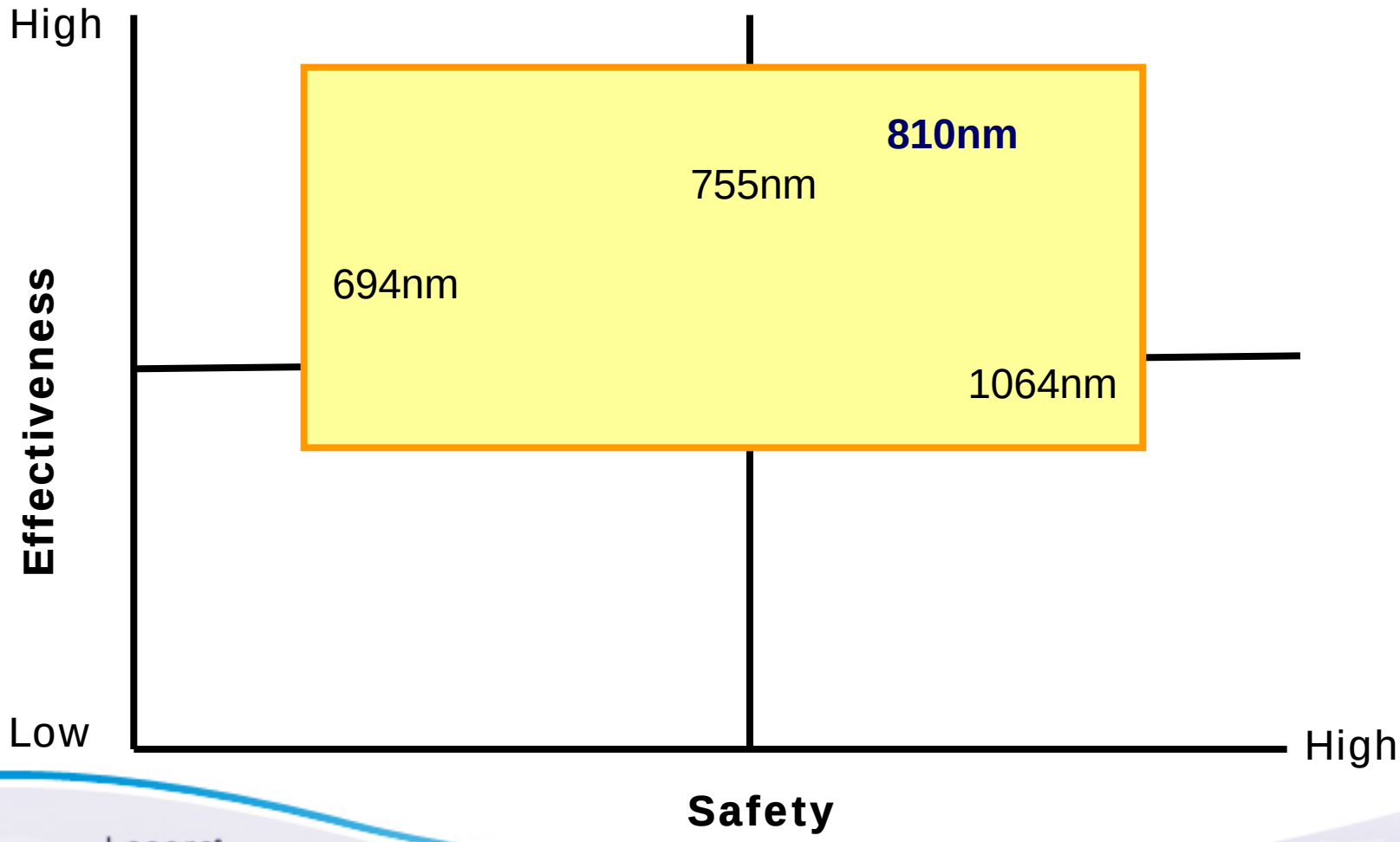
[1996 – 2011 ~600*]



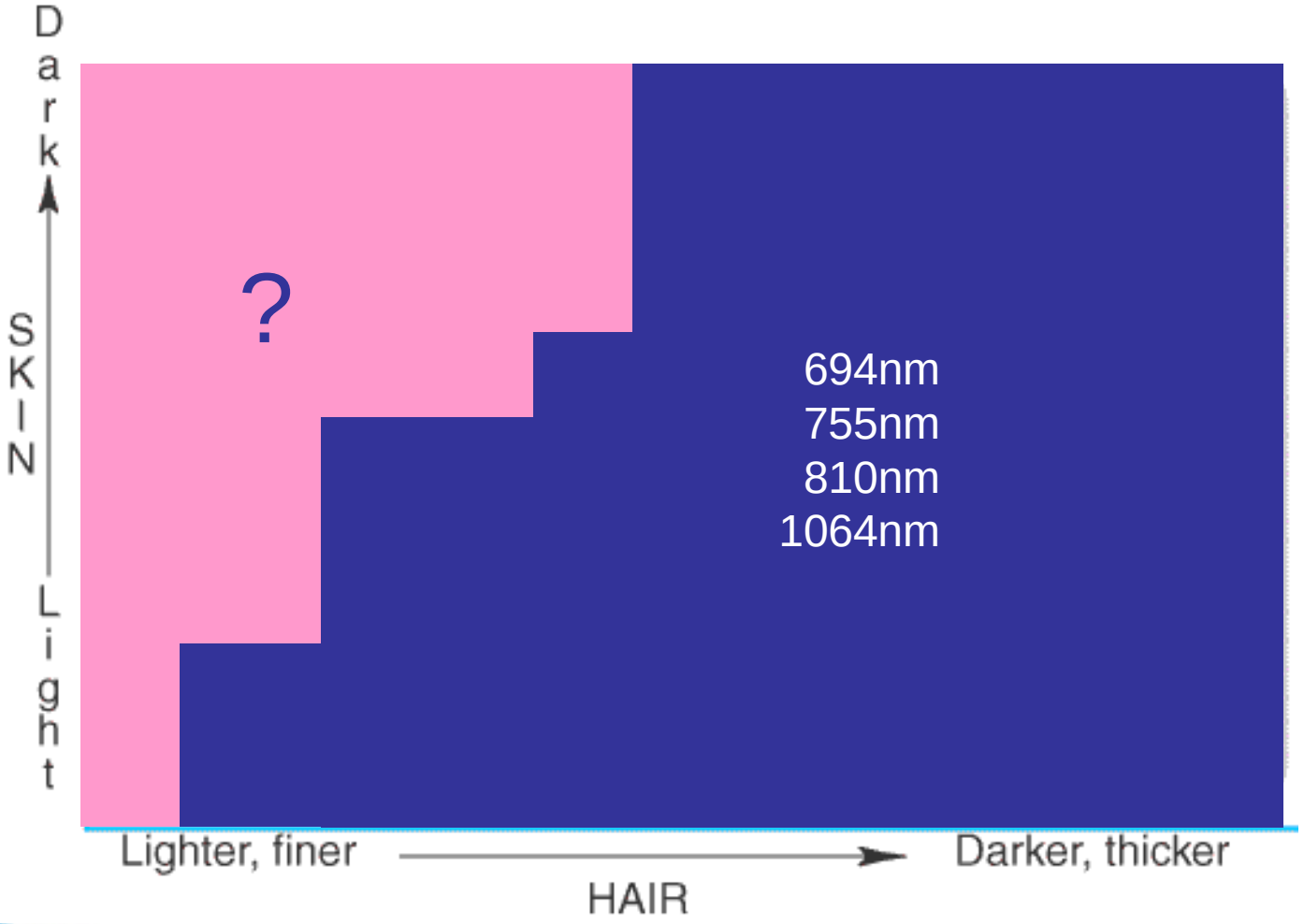
LHR Technology



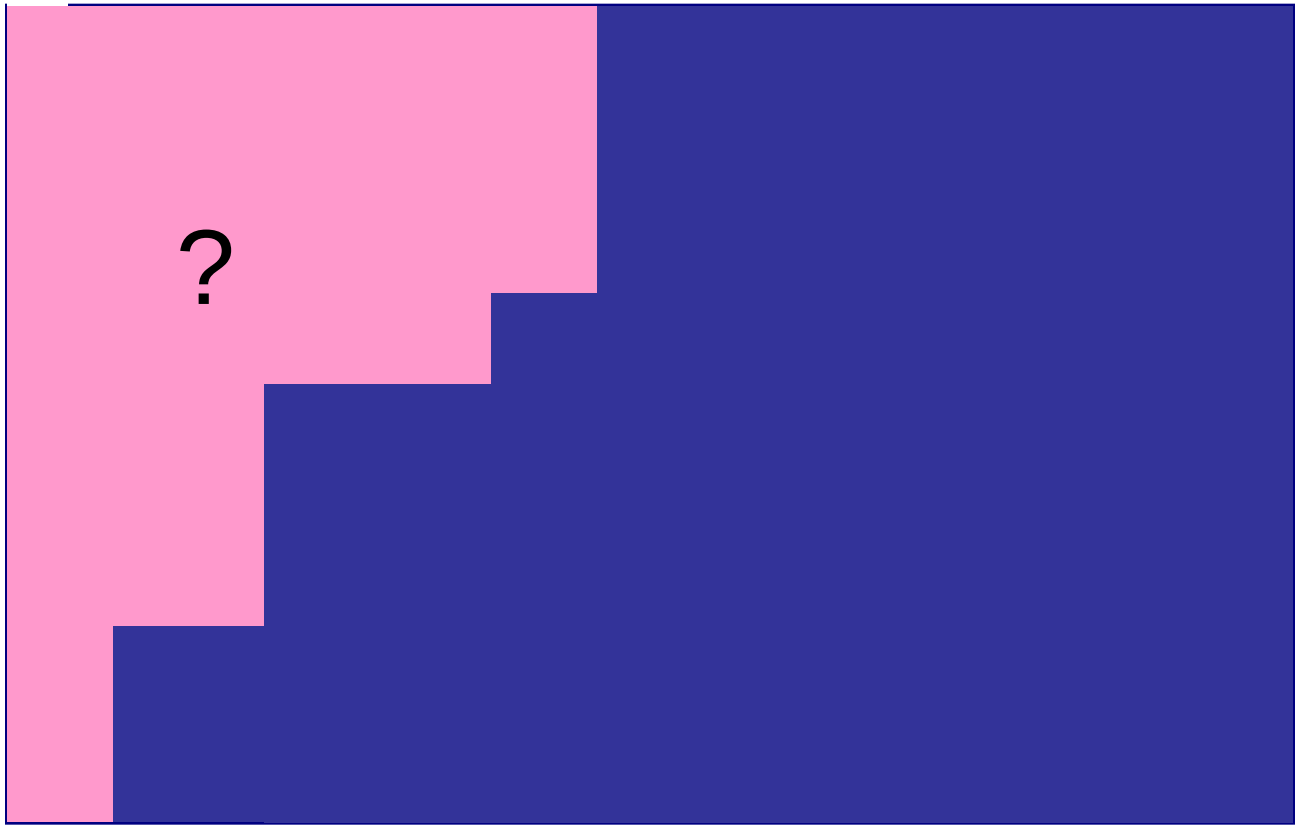
LHR Efficacy & Safety



LHR Technology



LHR Technology



LHR Technology

LHR

SHR

LHR Adverse Side Effects

- **Pain**
- Erythema
- Edema
- Dyspigmentation
- Foliculitis/pseudofoliculitis
- Crusting/blistering
- Burn

LHR Limitations

Factor	Solution
•Pain	•Local anesthesia, cooling, low energy, vacuum
•Burns dark skin	•Long pulse, long wavelength, strong cooling, low energy
•Thin hair	•No solution; many treatments
•Low efficacy	•High energy, short wavelength

Skin Interaction

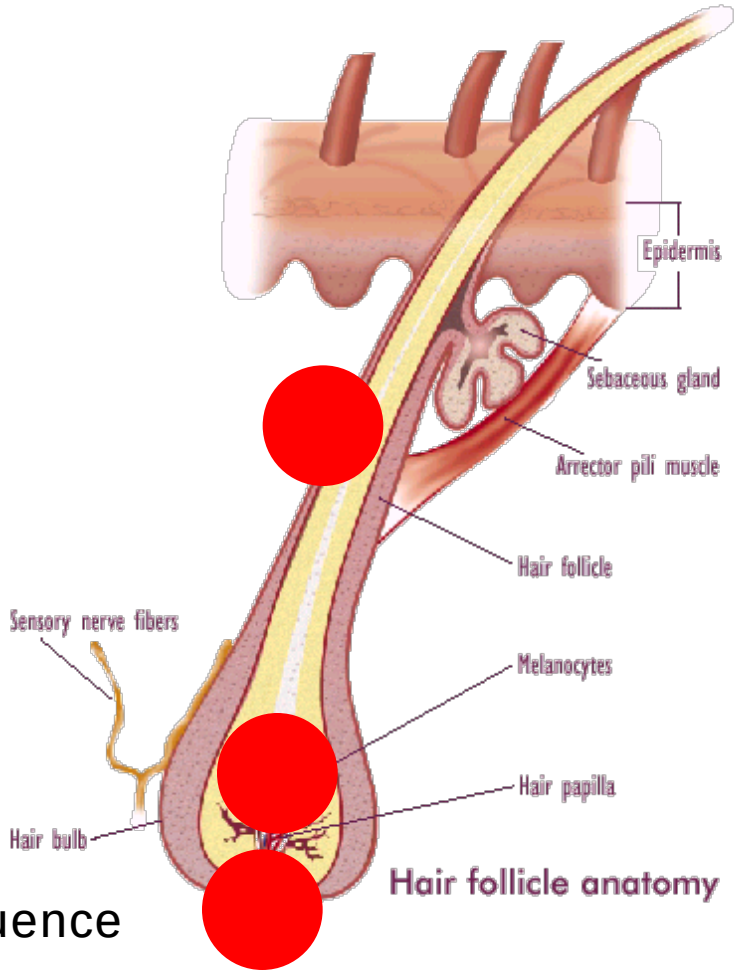
LHR

Selective Photothermolysis

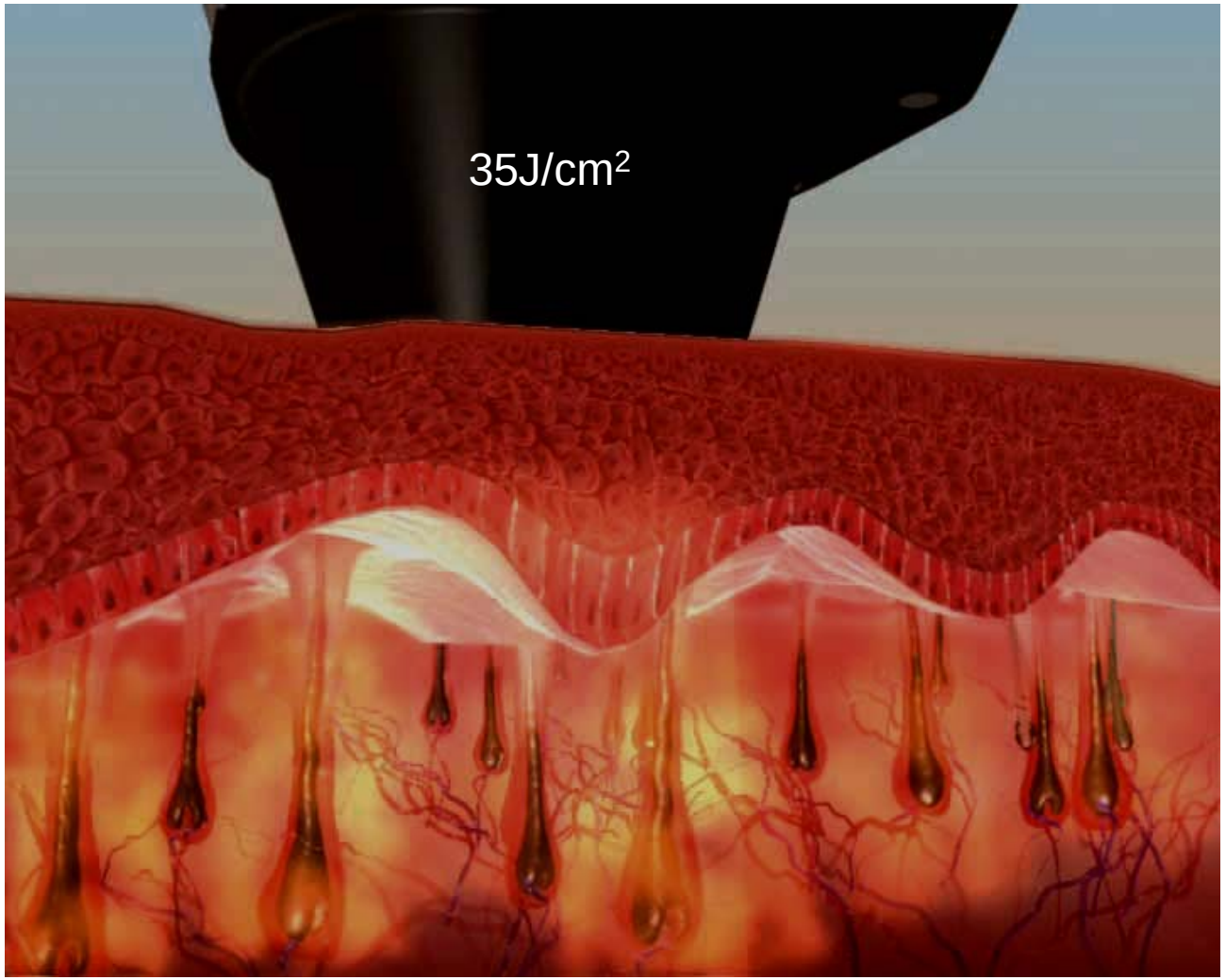
The laser optical energy* is absorbed by the melanin in the hair follicle.

The hair's bulb, bulge and papilla areas are heated.

The surrounding tissue remains unaffected.



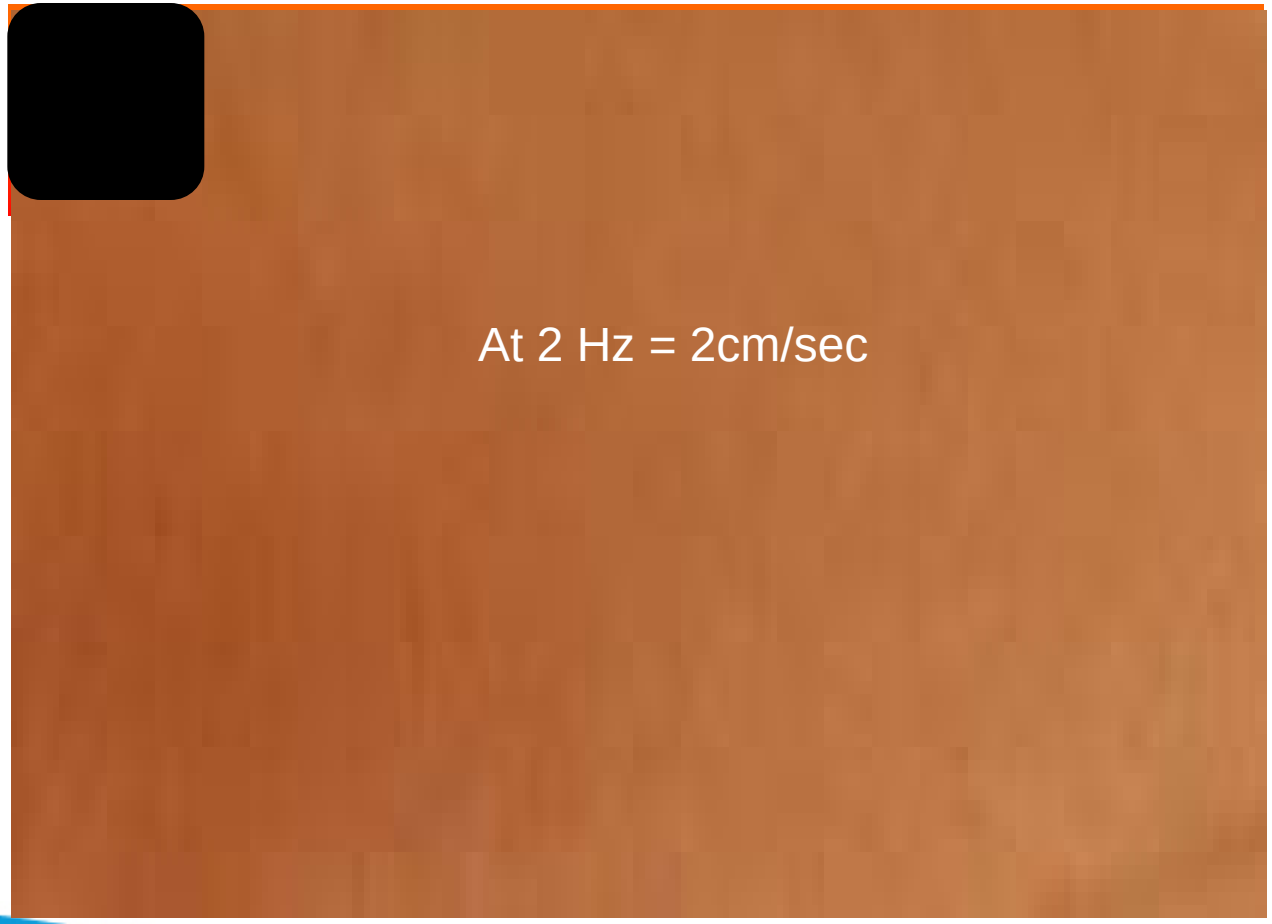
*Wavelength, pulse duration and fluence


35J/cm2

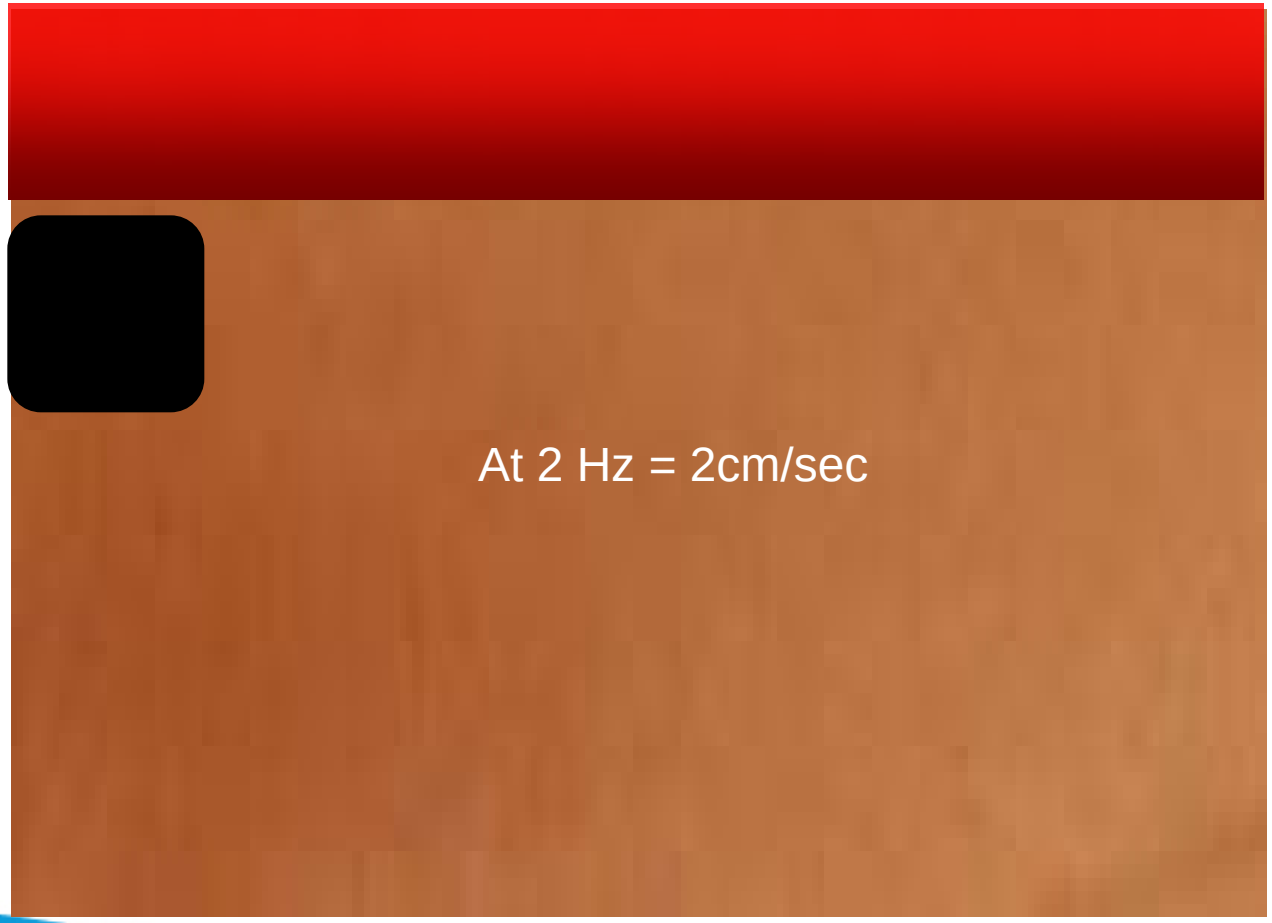
Problems with any high fluence laser

Burns, especially with dark skin tones

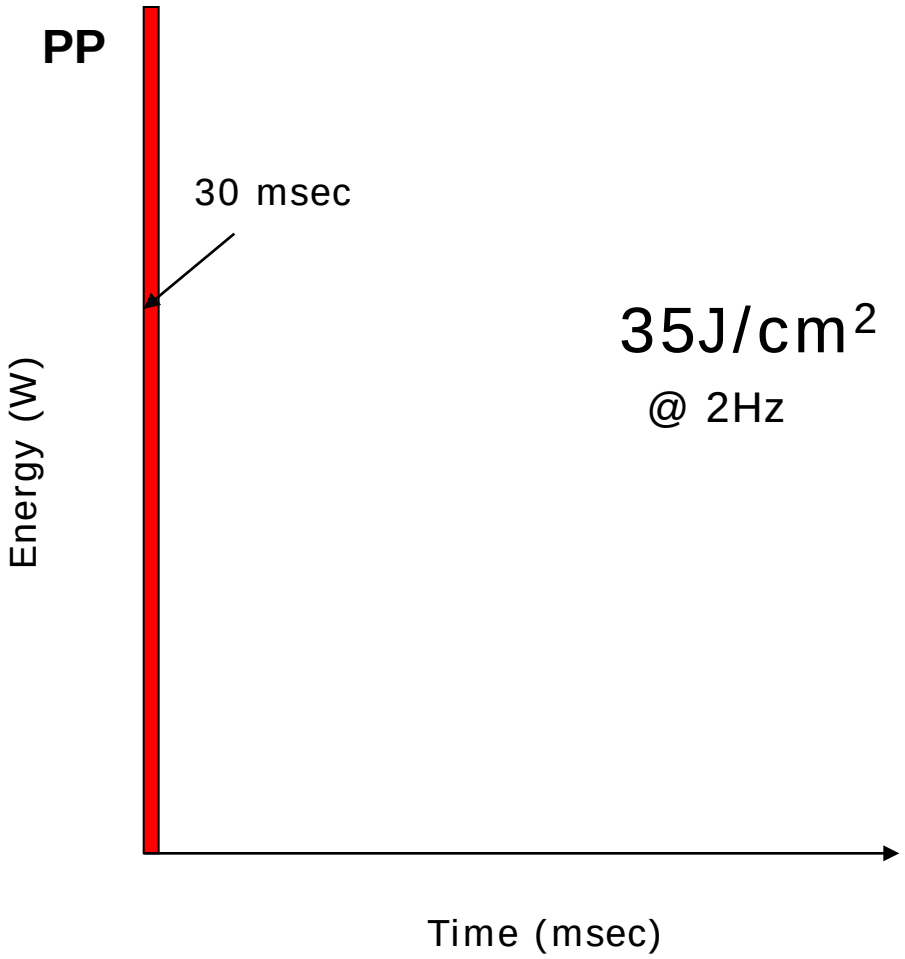
Standard Technique



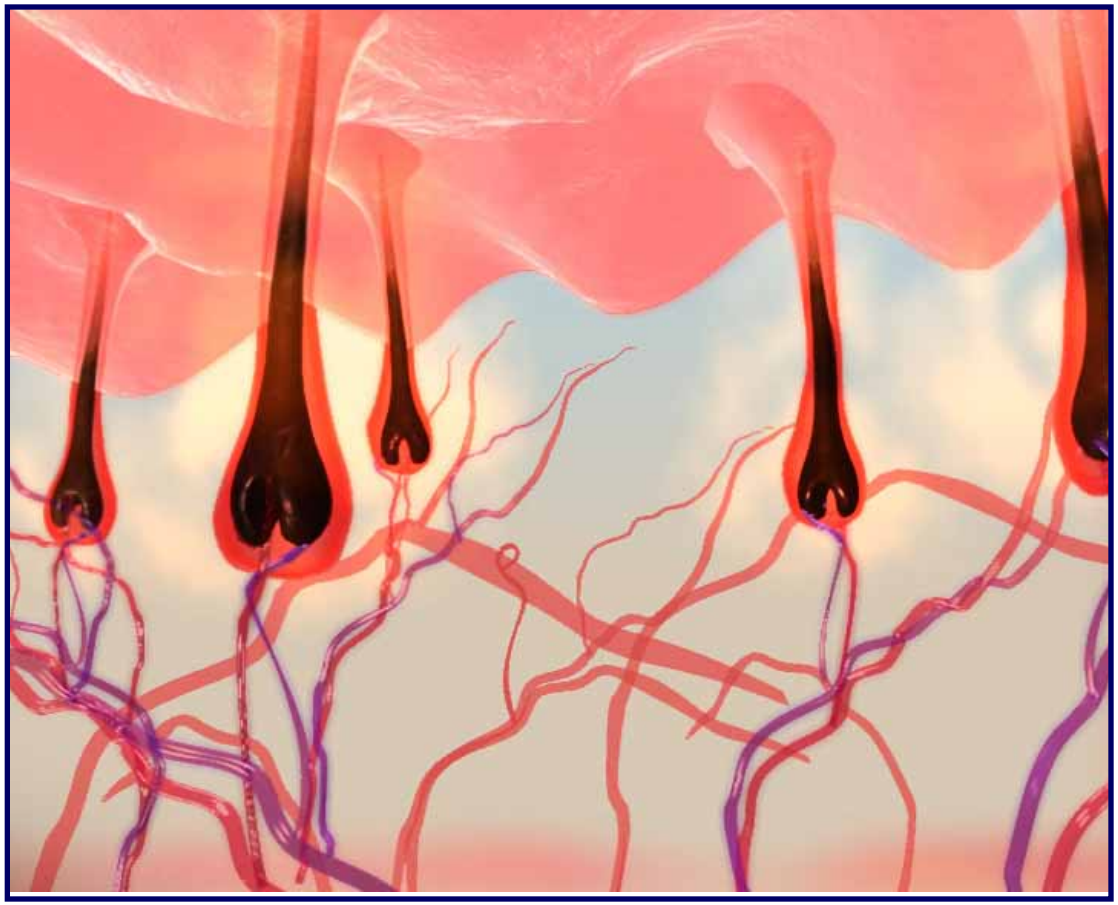
Standard Technique

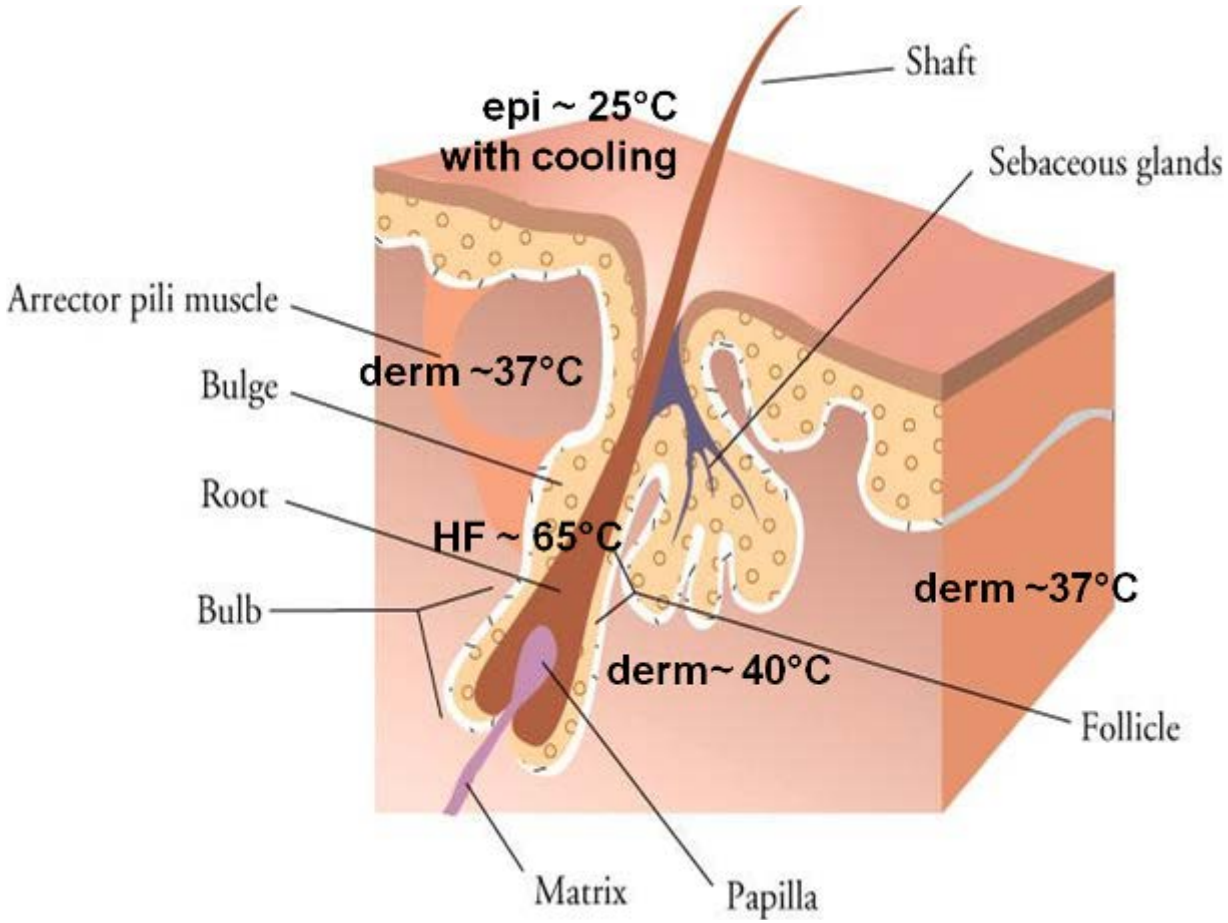


HR Pulse



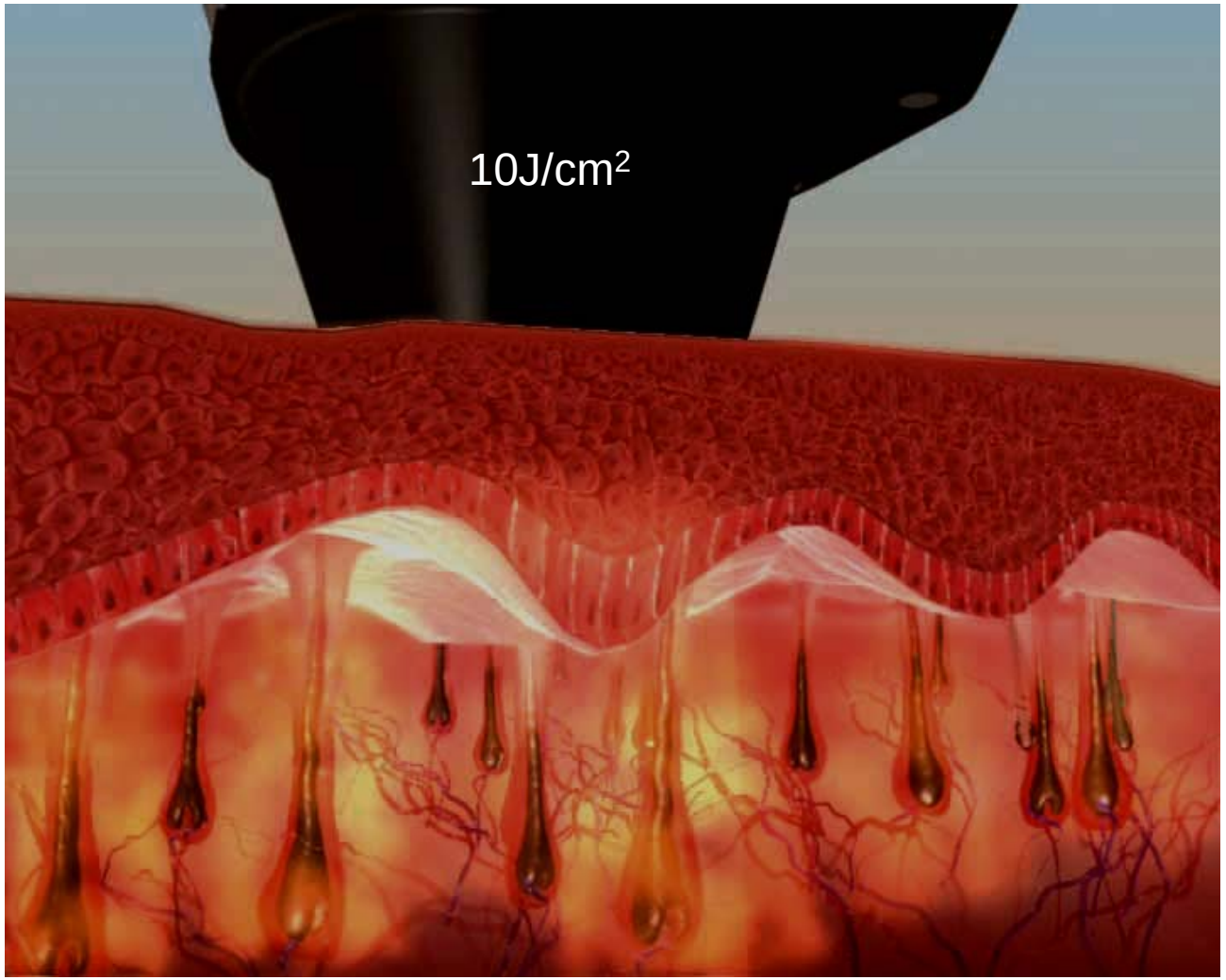
LHR Single Pulse/High Fluence



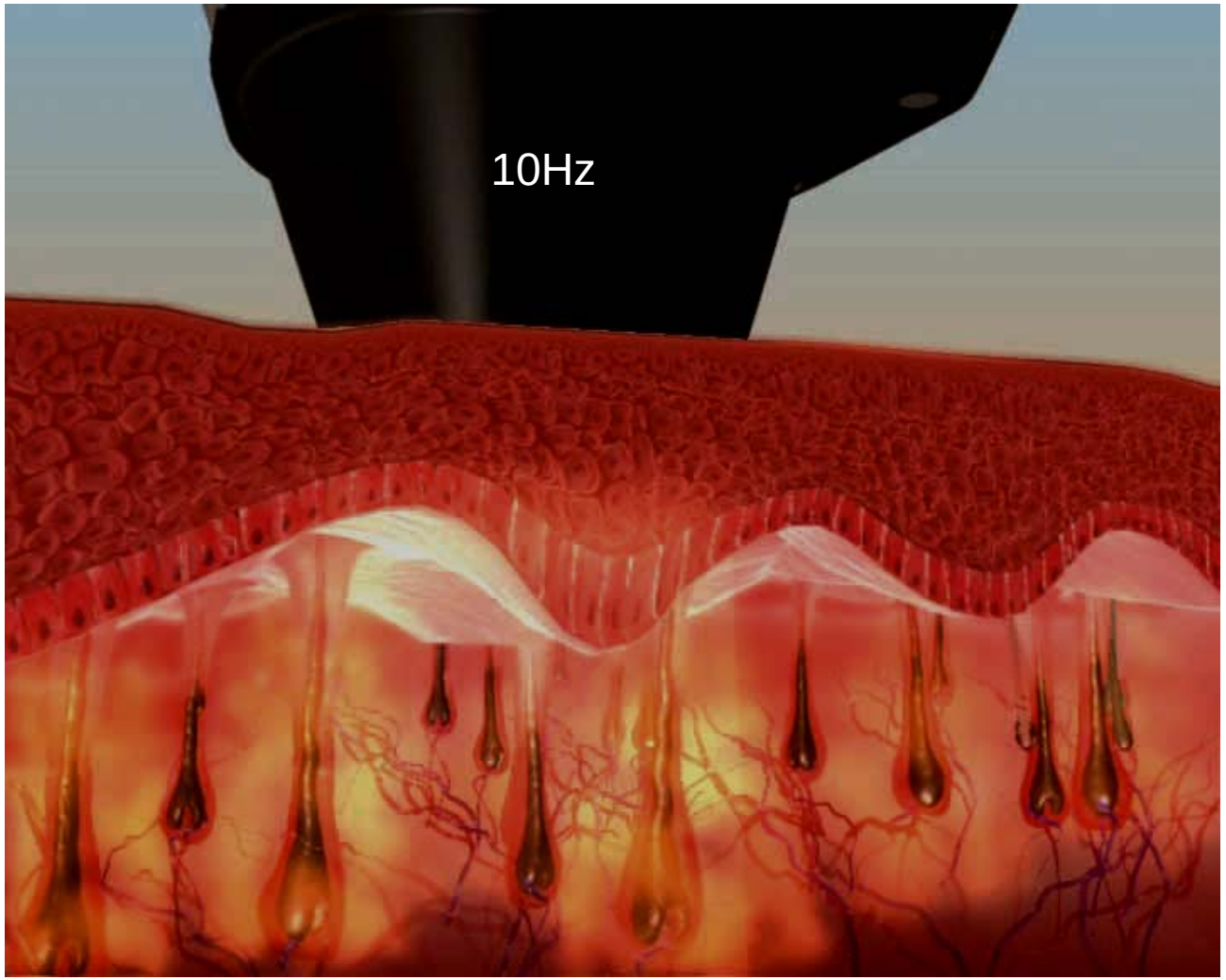

Shaft
epi ~ 25°C
with cooling
Sebaceous glands
Arrector pili muscle
derm ~37°C
Bulge
Root
HF ~ 65°C
derm ~37°C
Bulb
derm~ 40°C
Follicle
Matrix
Papilla

SHR

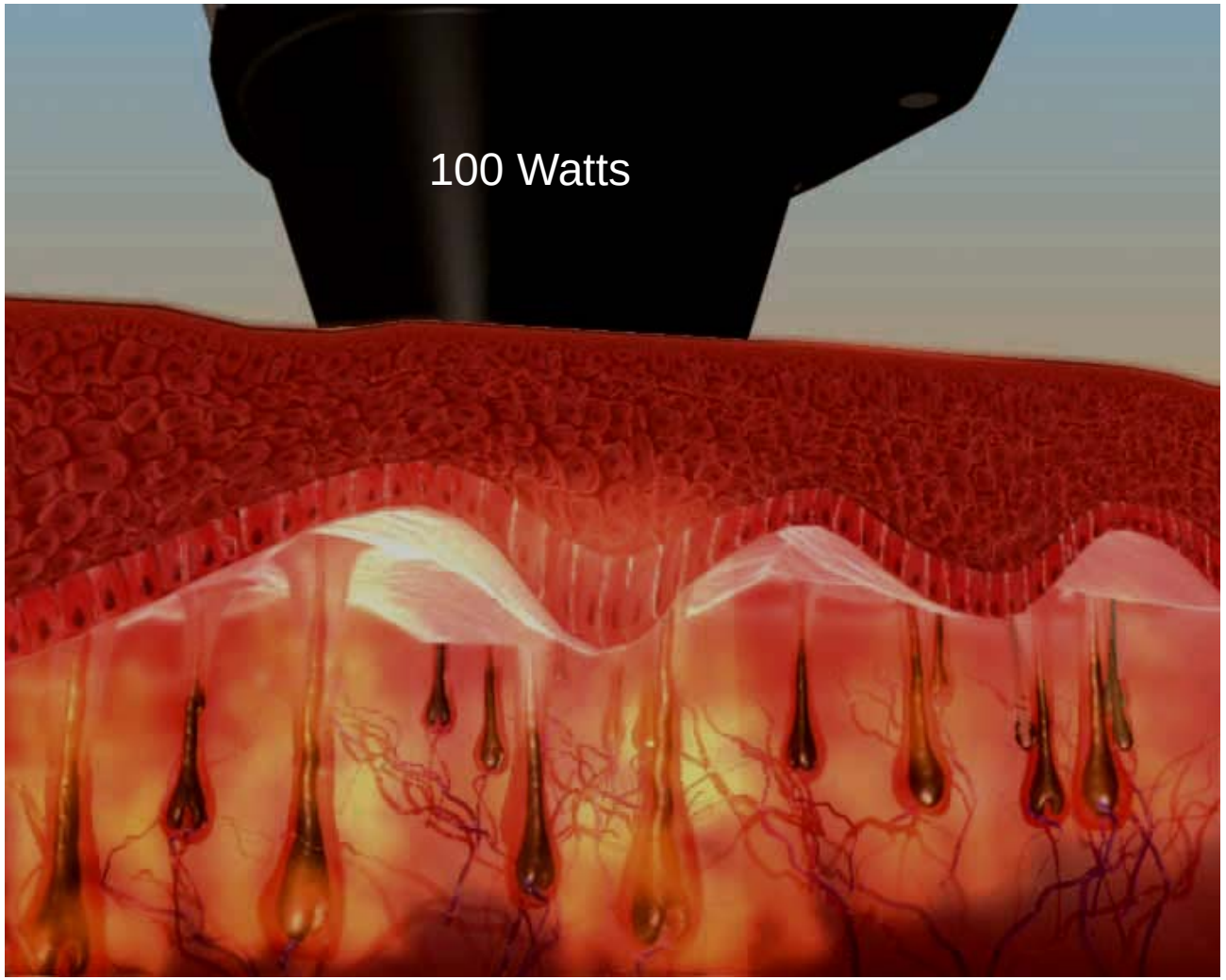
Fluence



Repetition Rate

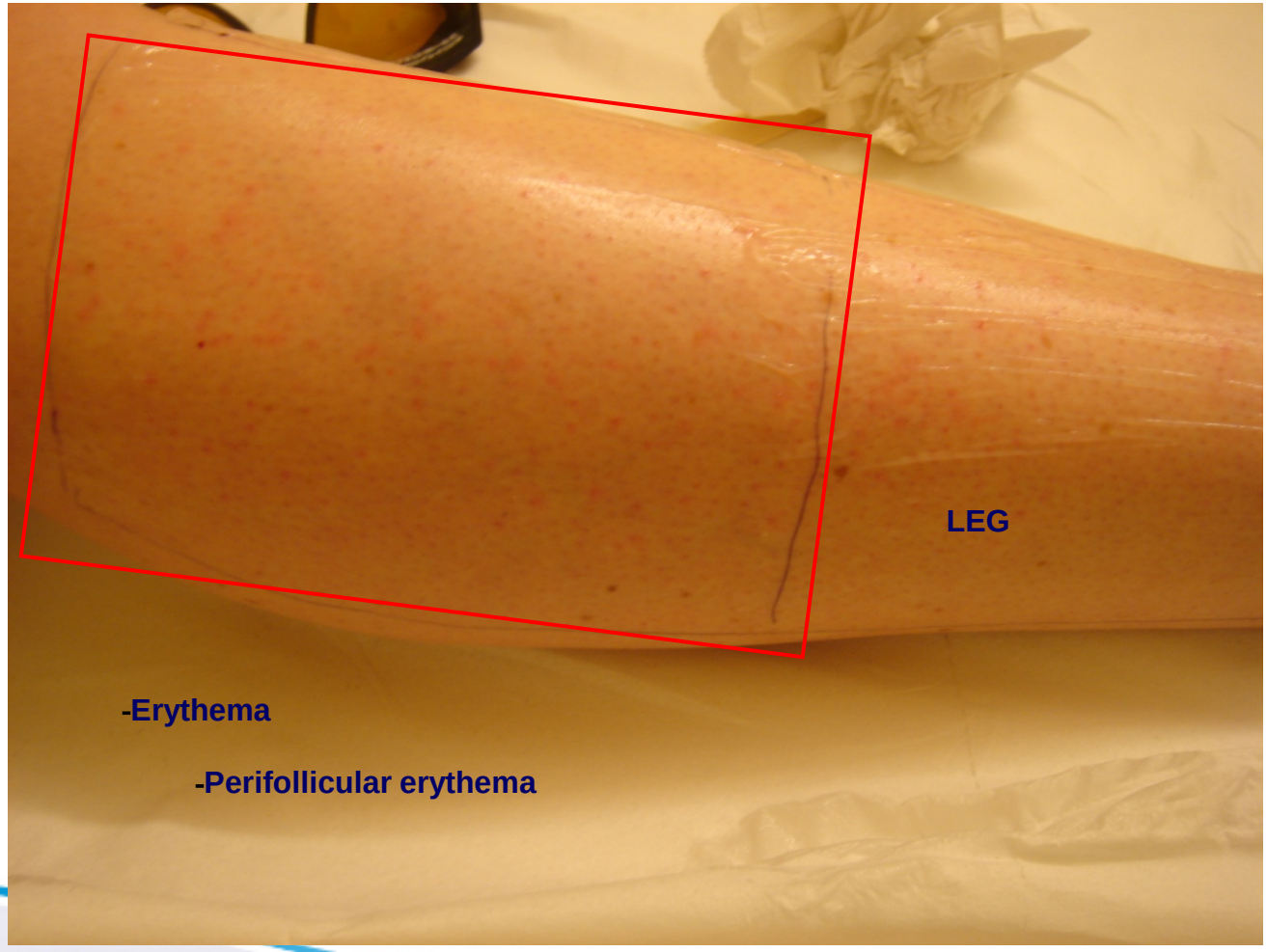


Average Power

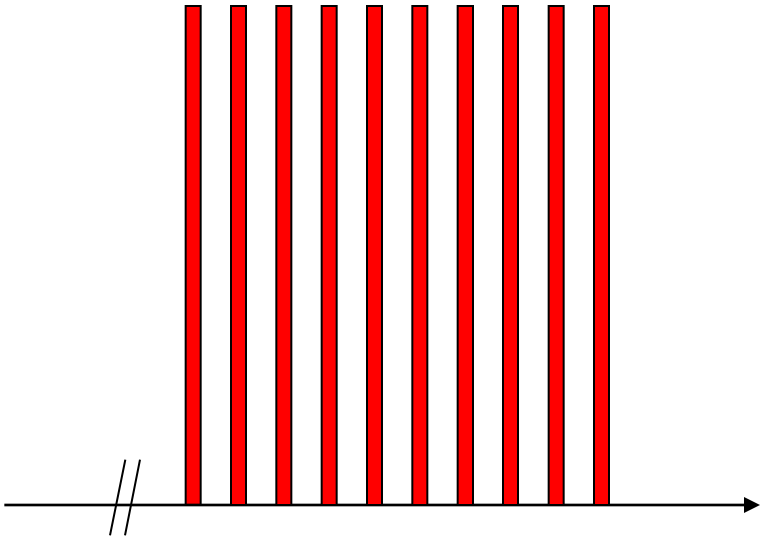


IN-Motion™ Technique

SHR End-Points

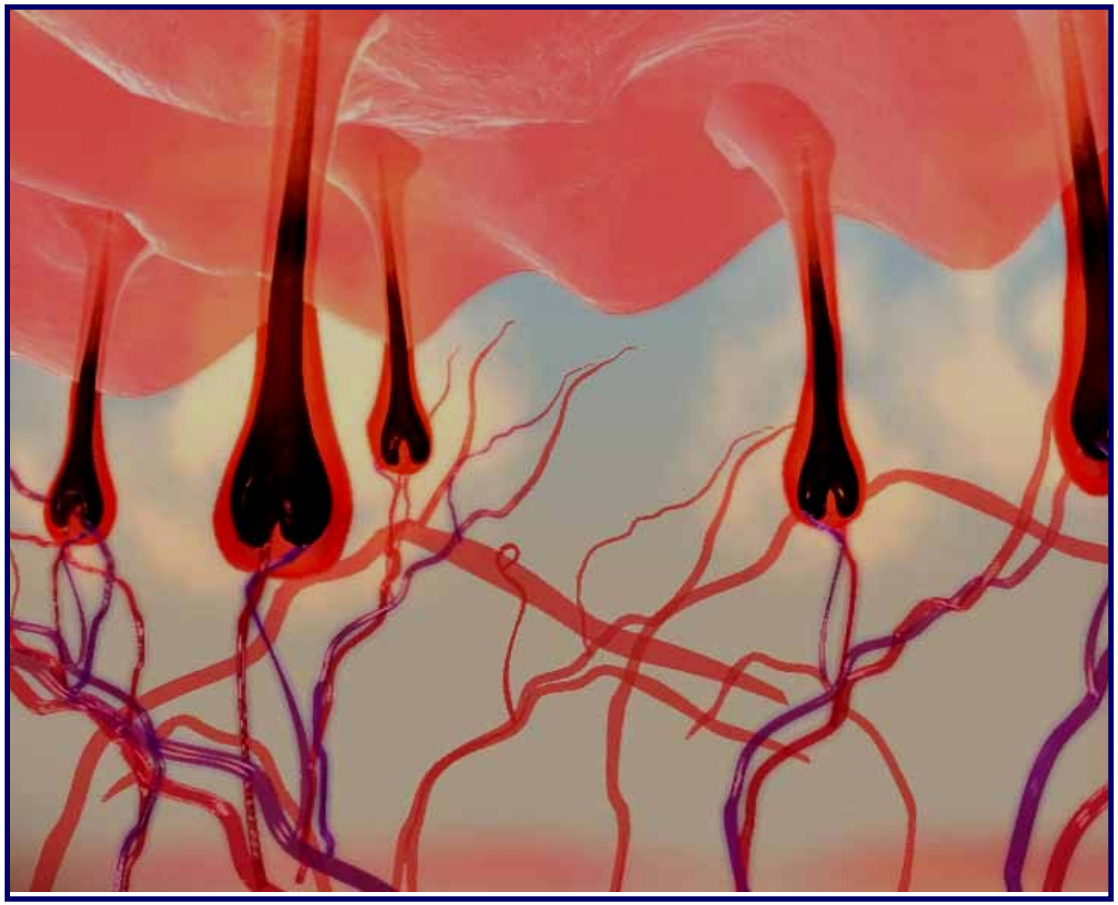


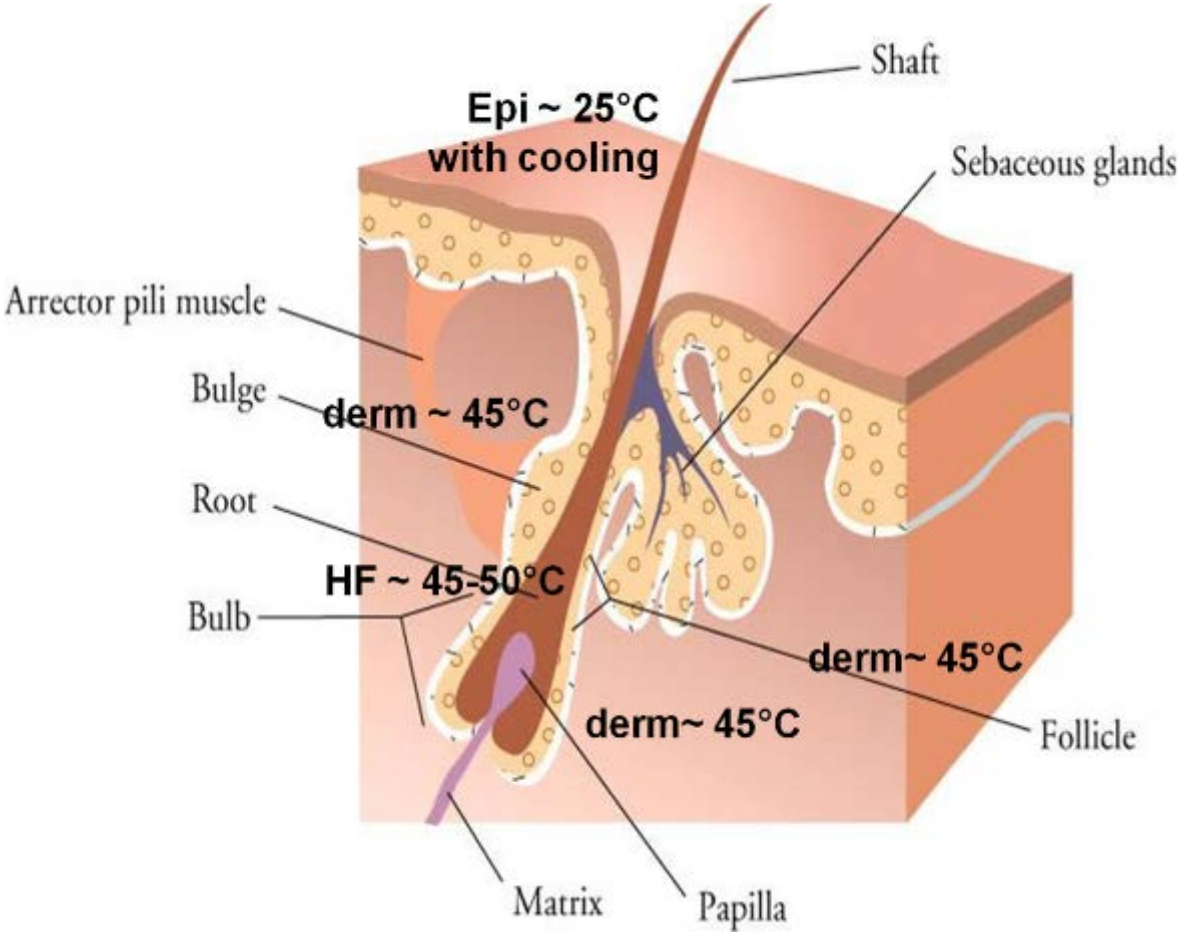
SHR Pulse



10J/cm^2

SHR Multi Pulse/Low Fluence




Shaft
Epi ~ 25°C
with cooling
Sebaceous glands
Arrector pili muscle
Bulge
derm ~ 45°C
Root
HF ~ 45-50°C
Bulb
derm~ 45°C
derm~ 45°C
Follicle
Matrix
Papilla

Old vs. New

LHR

- High peak power
- Low average power
- Low coverage rate
- Slow procedure
- Painful
- Anesthetic required
- Adverse side effects

SHR

- **Low peak power**
- **High average power**
- **IN MOTION; fast**
- **No anesthetic**
- **Virtually no pain**
- **No adverse side effects**

What Is SHR?

A photo-thermal event by which preset parameters - wavelength, pulse duration, very high average power, low fluence, and very fast repetition rate laser beam cause step-wise, accumulative, heat build-up to both the dermis and hair follicle.

- Reduced pain sensation.
- Reduced risk of adverse side effects.
- Improved results with thin, light colored hair.

New ‘In Motion’ Technique!

… *What Is* IN-Motion™ *Technique?*

In-motion technique creates a high average output power, while utilizing low fluence and high repetition rate for the ultimate virtually painless procedure.

IN-Motion™ Technique Advantages

- Replacing the old stationary method in Lasers and IPLs
- Providing safer treatments by raising a large area's temp. gradually and allowing even distribution of energy and faster treatments
- Allowing using lower energy levels and achieving the same high efficacy as the old stationary method
- Less risk for complications and more control during the procedure
- Less burning/stinging sensation for the patient- virtually pain free treatments!

SHR Biometrics

Total Energy (kJ)

$[J/cm^2] \times [Hz] \times \text{time [sec]} = kJ$

$10\ [J/cm^2] \times 10\ [Hz] \times 80\ [sec] = 8{,}000J$

100J/sec

8kJ

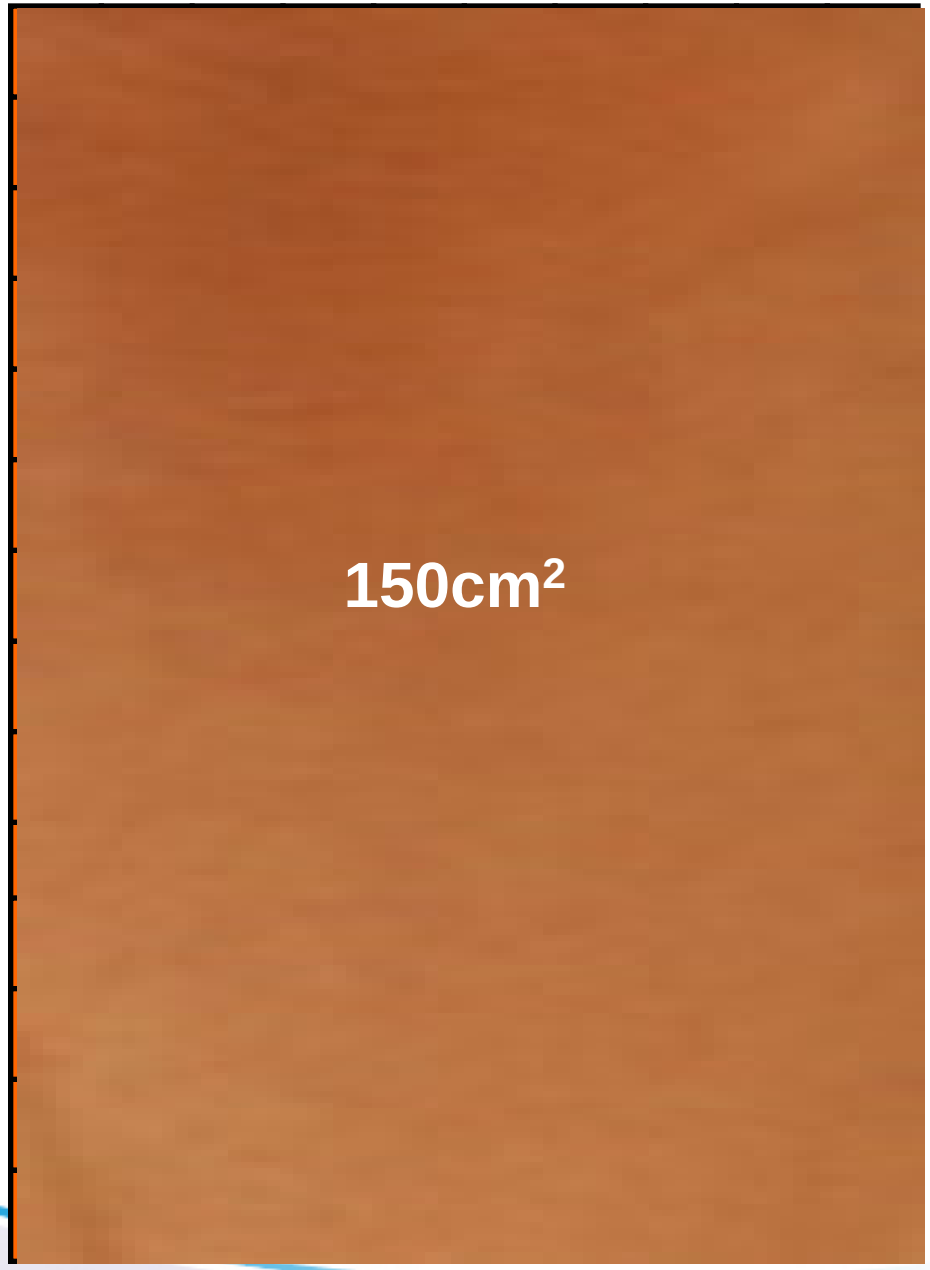
***1kJ = 1000J**


1
2
3
4
8
7
6
5
9
10
11
12
14
13


8
7
6
5
9
10
11
12
14
13

10 cm

15 cm



Alma Lasers®
Wellbeing Through Technology®

10 cm

15 cm

Alma Lasers®
Wellbeing Through Technology®

10 cm

SHR

1x1 cm²

Average ~53 J/cm²

15 cm

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14 x 80 sec = 1120sec = 18.66 minutes

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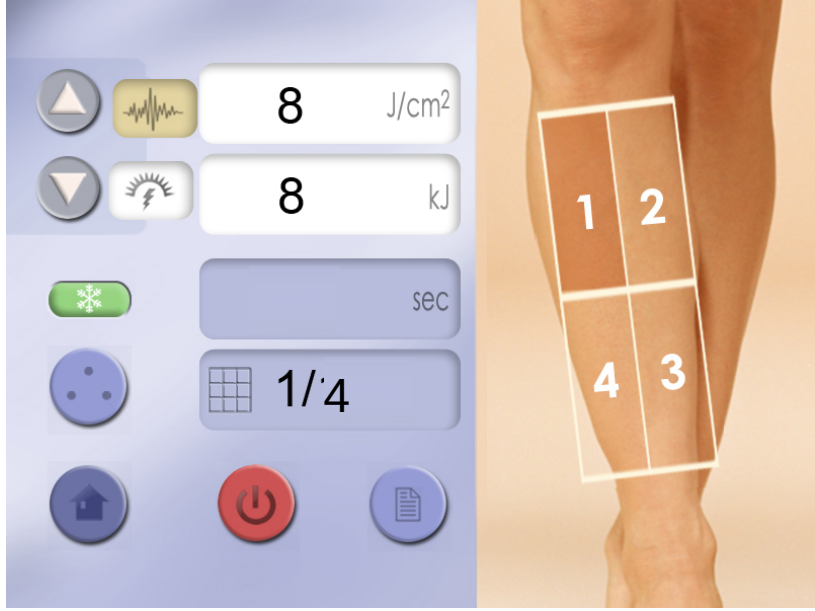
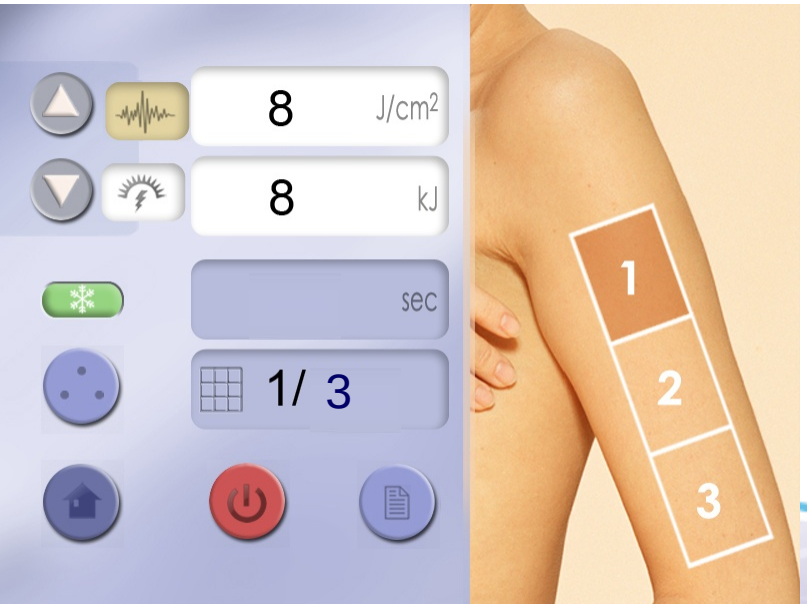
12” Screen
SHR – Female Treatment Areas

Abdomen

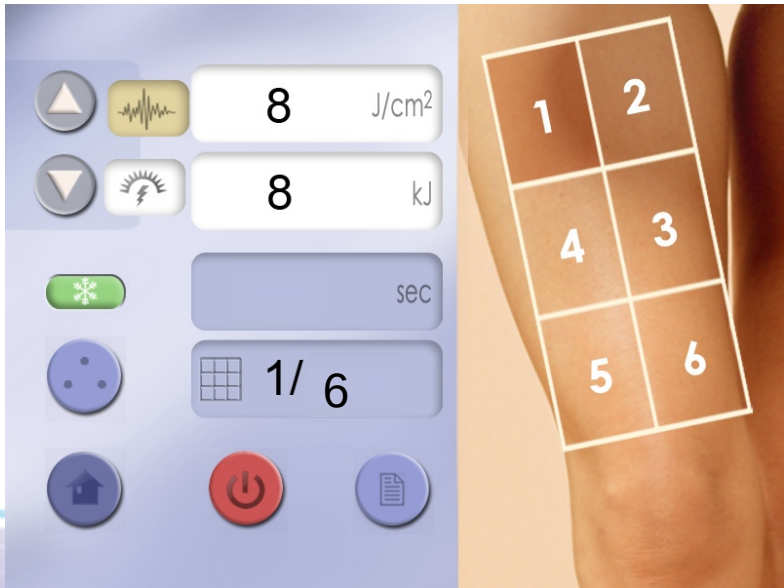


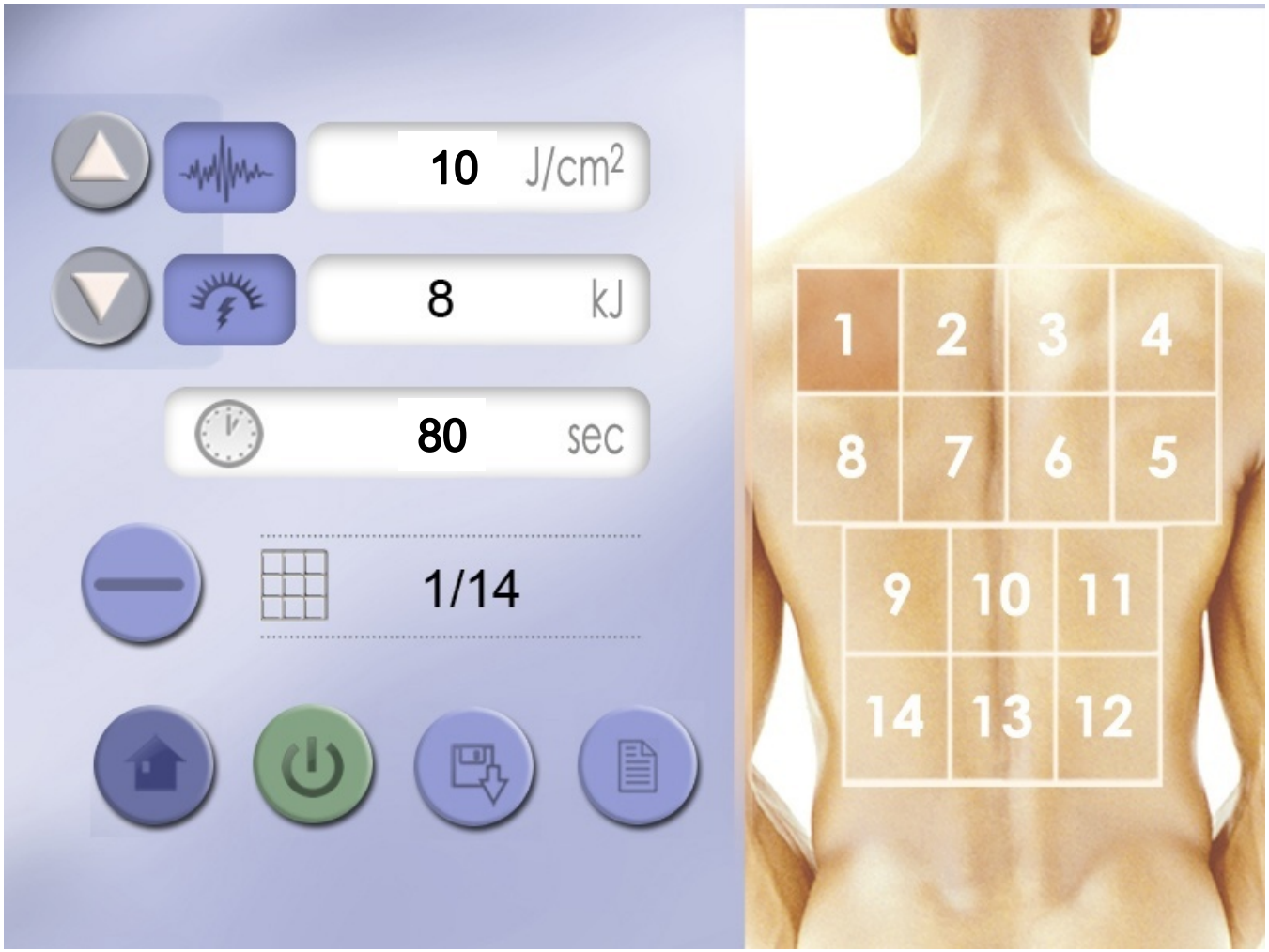
Calve

Arm



Thigh




10 J/cm2
8 kJ
80 sec
1/14
1 2 3 4
8 7 6 5
9 10 11
14 13 12

SHR Settings

Fitzpatrick Skin Type	Fluence (J/cm^2)
I-III	9-10
IV	7-8
V-VI	5-6

SHR Settings/Asian Skin

Fitzpatrick Skin Type	Fluence (J/cm^2)
I-III	8-9
IV	6-7
V-VI	5-6

SHR Thin Hair Settings

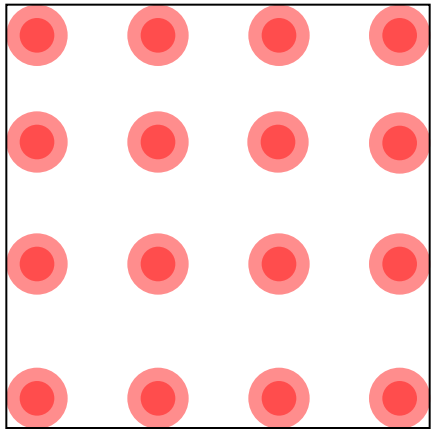
Fitzpatrick Skin Type	Fluence (J/cm^2)
I-III	18 -20
IV	14-16
V-VI	- -

Hair Density Consideration

Hair Density and Temperature

Low Thermogenic Effect

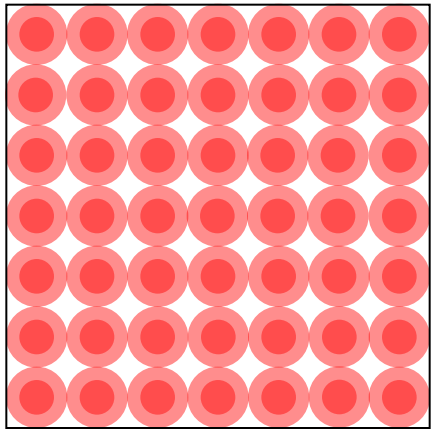
C°



Non-dense

High Thermogenic Effect

C°

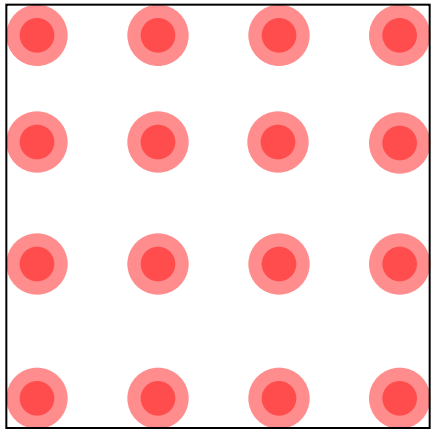


dense

Hair Density and Temperature

Low Thermogenic Effect

C°

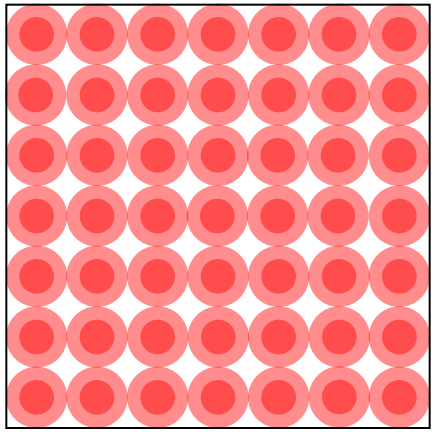


Non-dense

10kJ

High Thermogenic Effect

C°

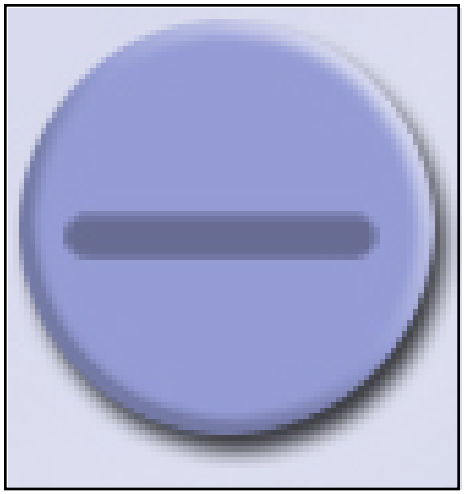


dense

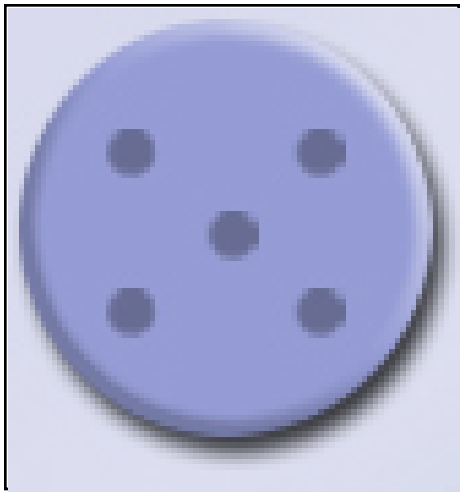
8kJ

Small Areas Stack Mode

SHR (Non-Stack)



SHR (Stack)



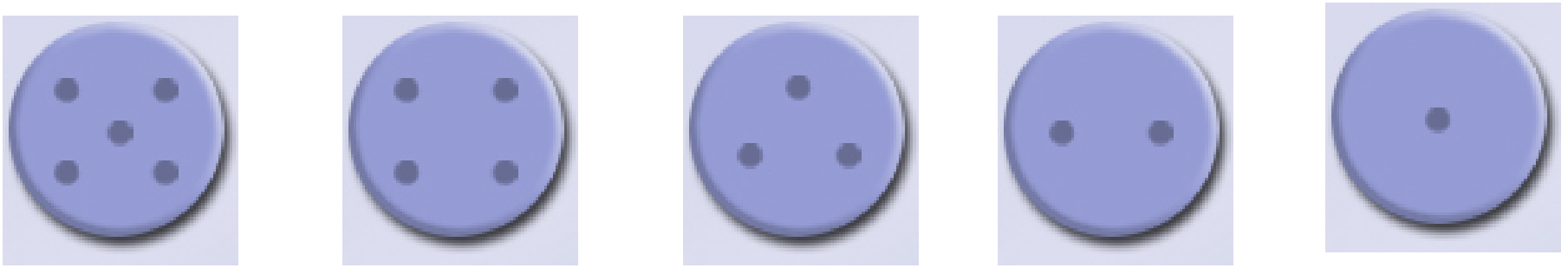
“Stack” Mode

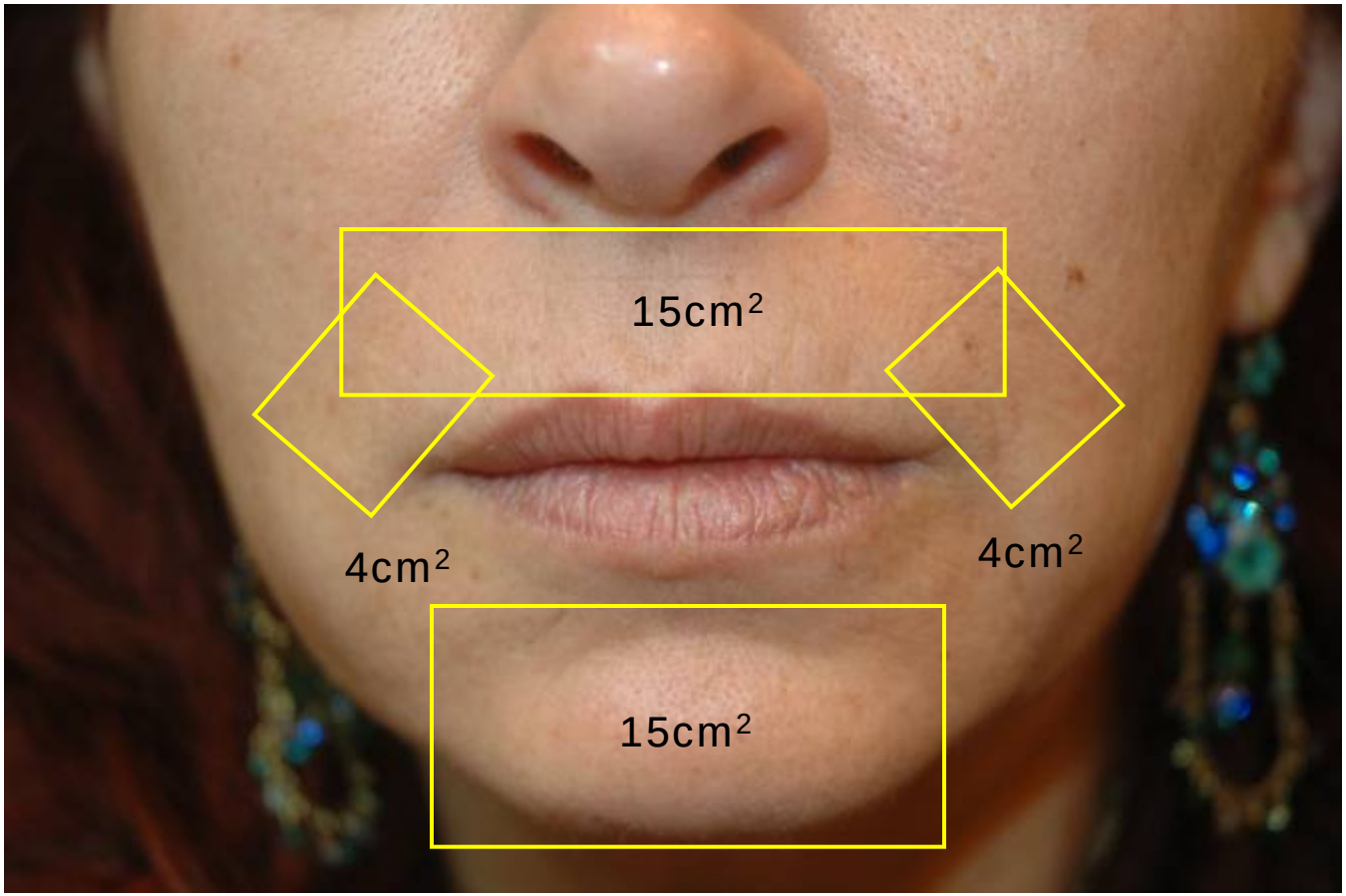
- The “Stack” mode is indicated when small areas up to 25 cm^2 such as upper lip, chin, bikini line, back of the hand.

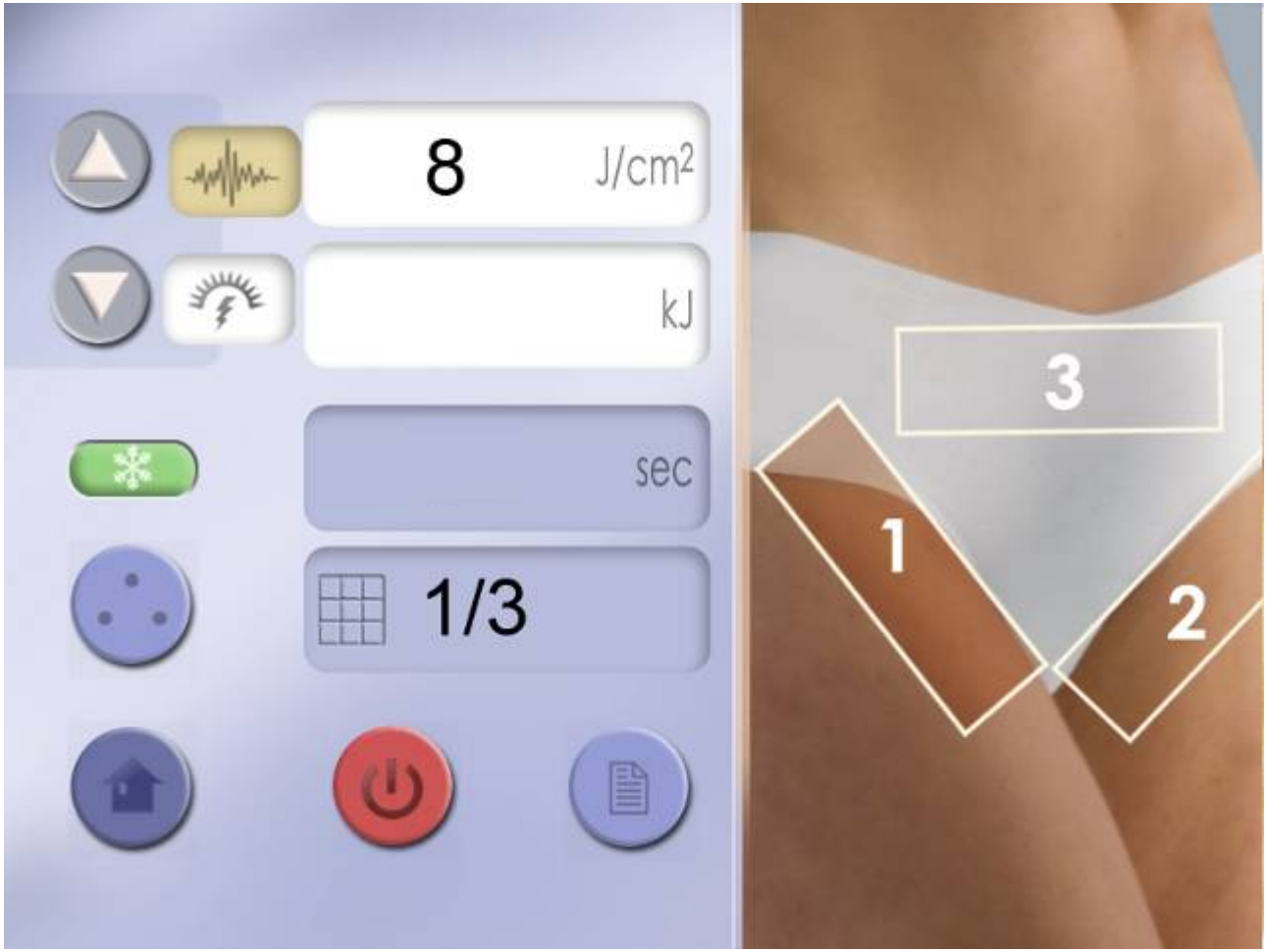
“Stack” Mode

The “Stack” mode is being used in small areas (up to 25 $cm^{2)}$ such as perioral area (upper lip, chin), sideburns, submental, back of the hand.

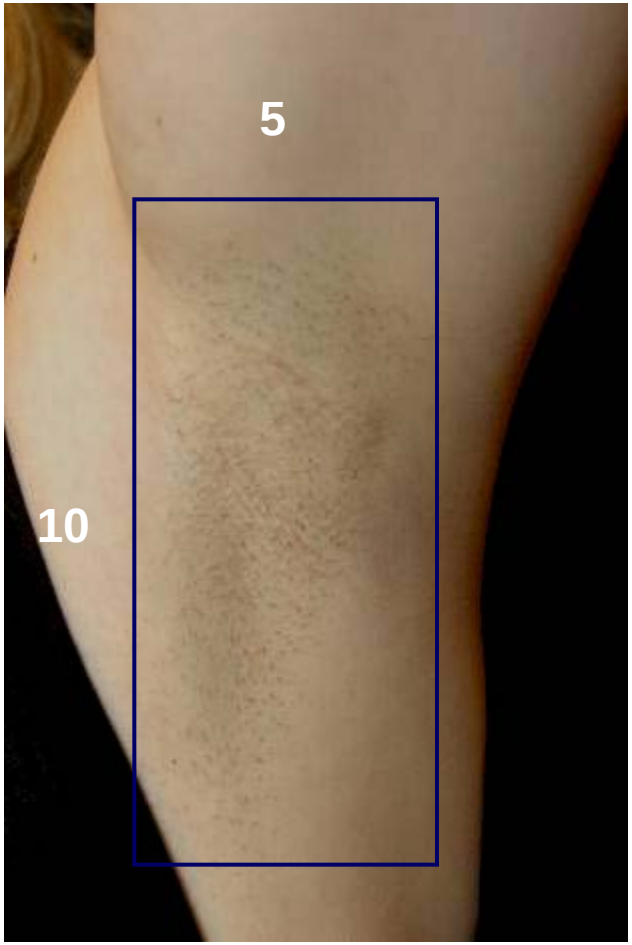
The “Stack” mode can be used up to $10J/cm^2$.



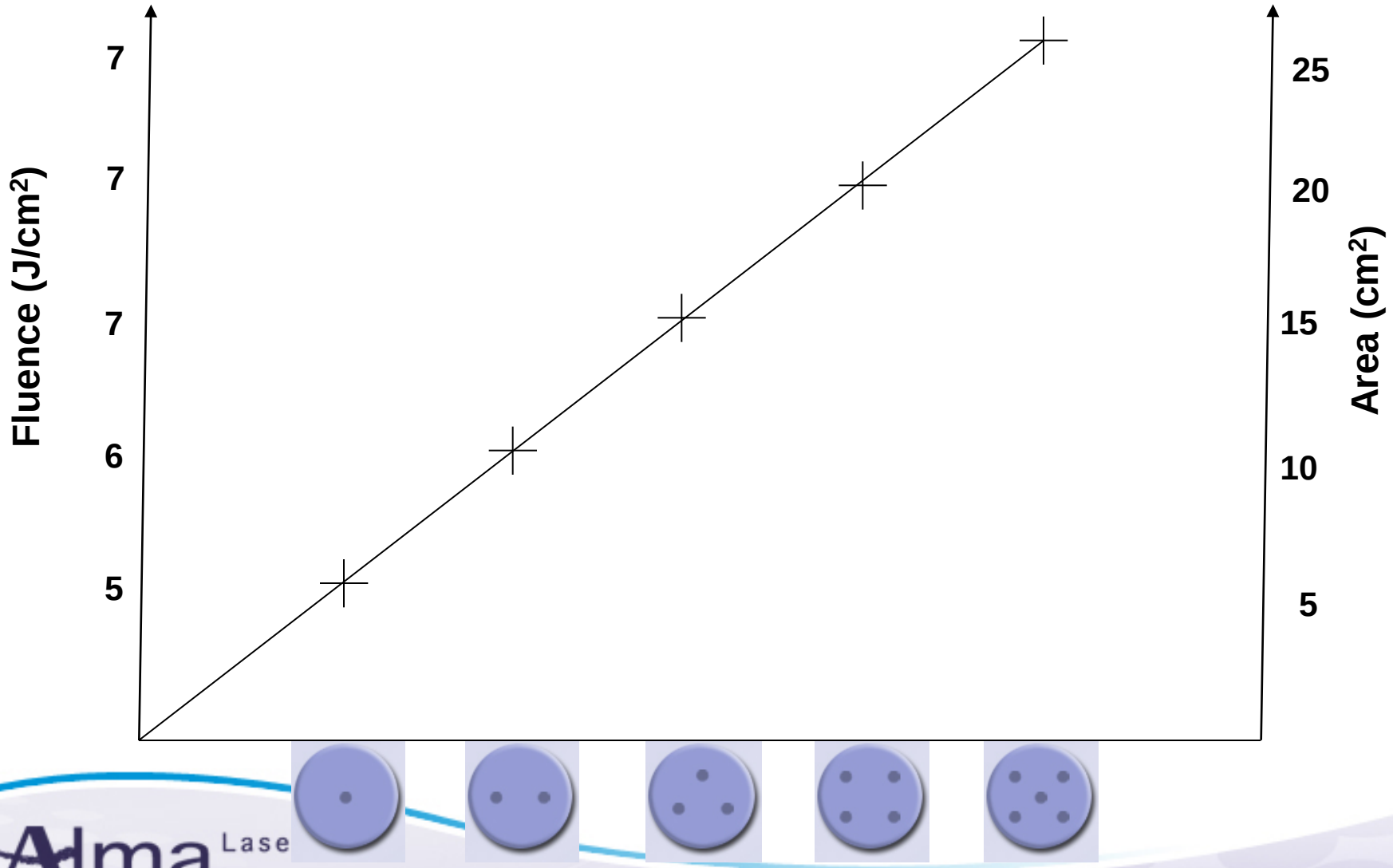

15cm²
4cm²
4cm²
15cm²


8
J/cm2
kJ
sec
1/3
3
1
2

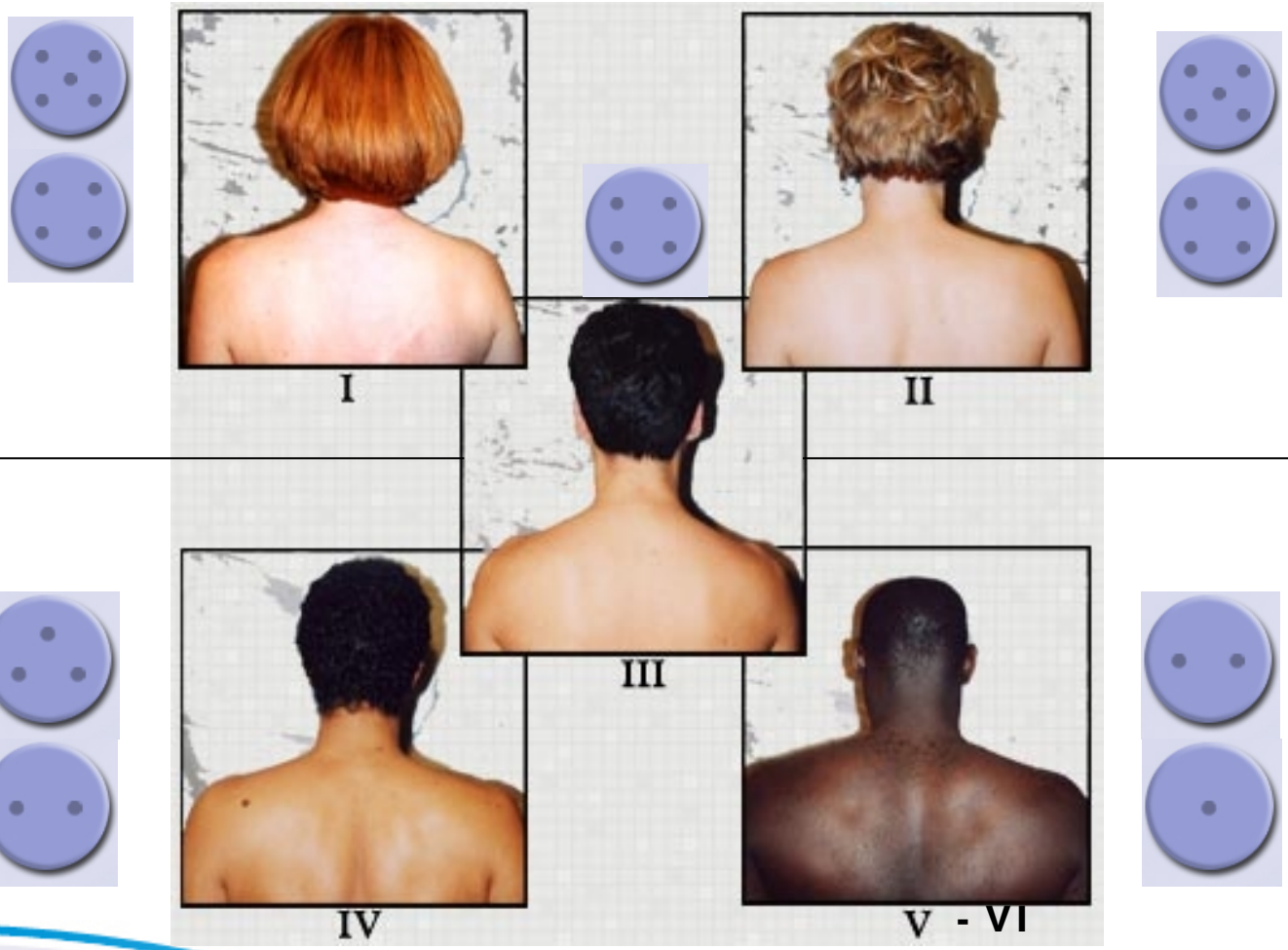

5
5


5
10

“Stack”



“Stack” vs Skin Types

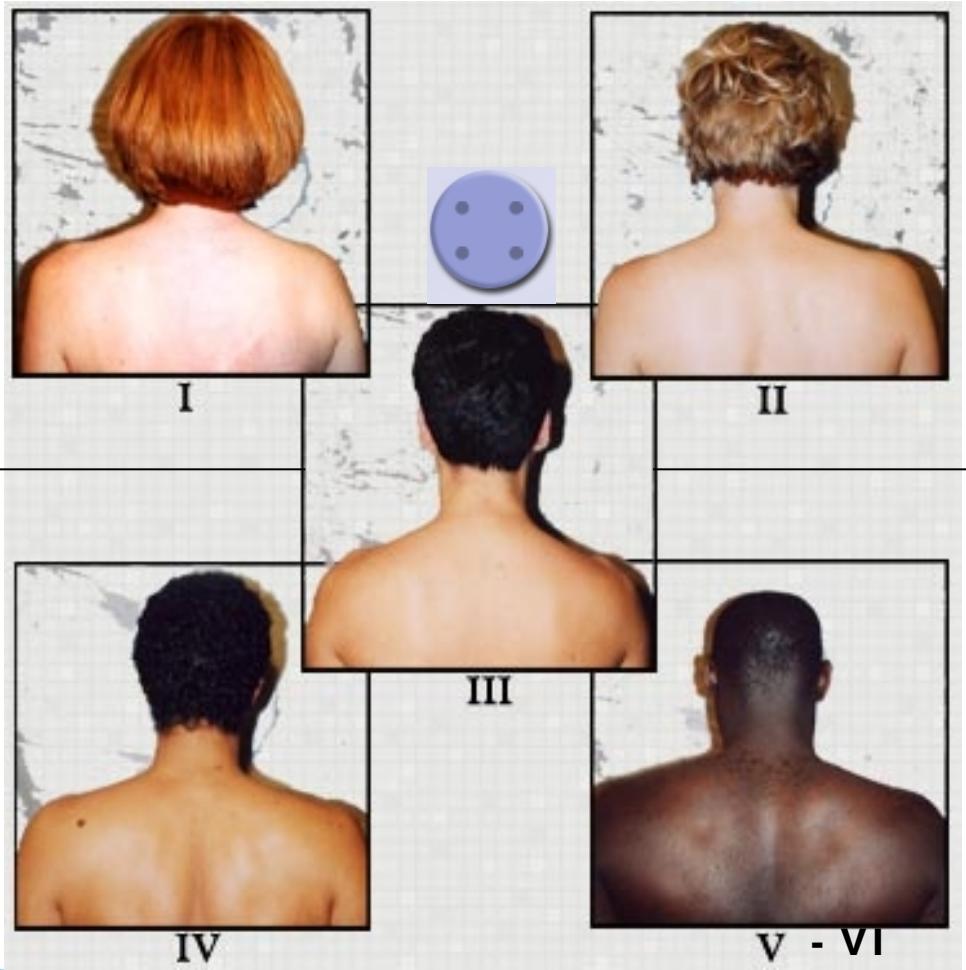


“Stack” vs Skin Types

7J/cm²

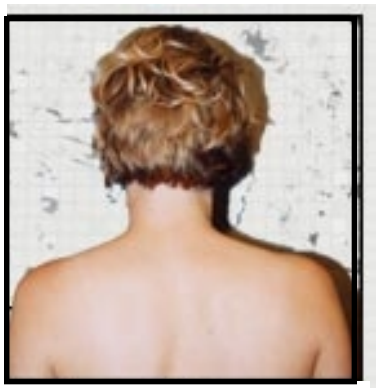
6J/cm²

5J/cm²



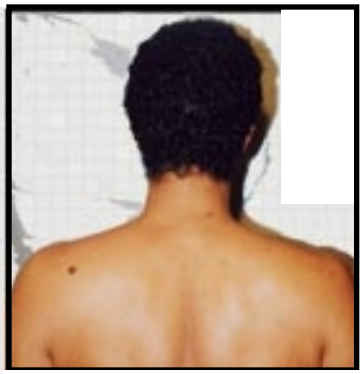
“Stack” Stationary

7J/cm^2



II

IV



6J/cm^2

Small Areas

Stack Mode Settings

Skin Type (Fitzpatrick I-VI)	*Fluence (J/cm²)*	*Accumulative Energy (kJ)*
I-III	7-8	4 – 5
IV	6-7	3 – 4
V	6	2.5 – 3.5
VI	5	2 – 3

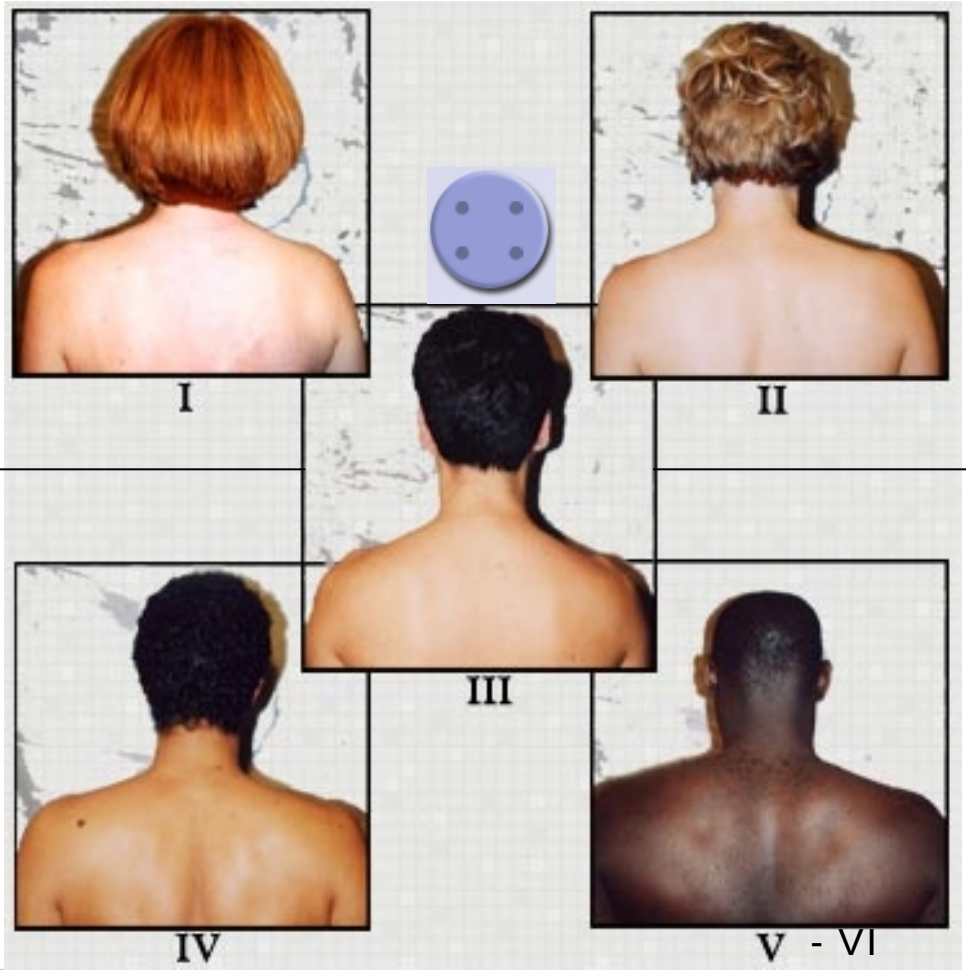
* Repetition Rate is fixed @ 10Hz
** Grid size: up to 25 cm²

“Stack” Algorithm

7J/cm^2

6J/cm^2

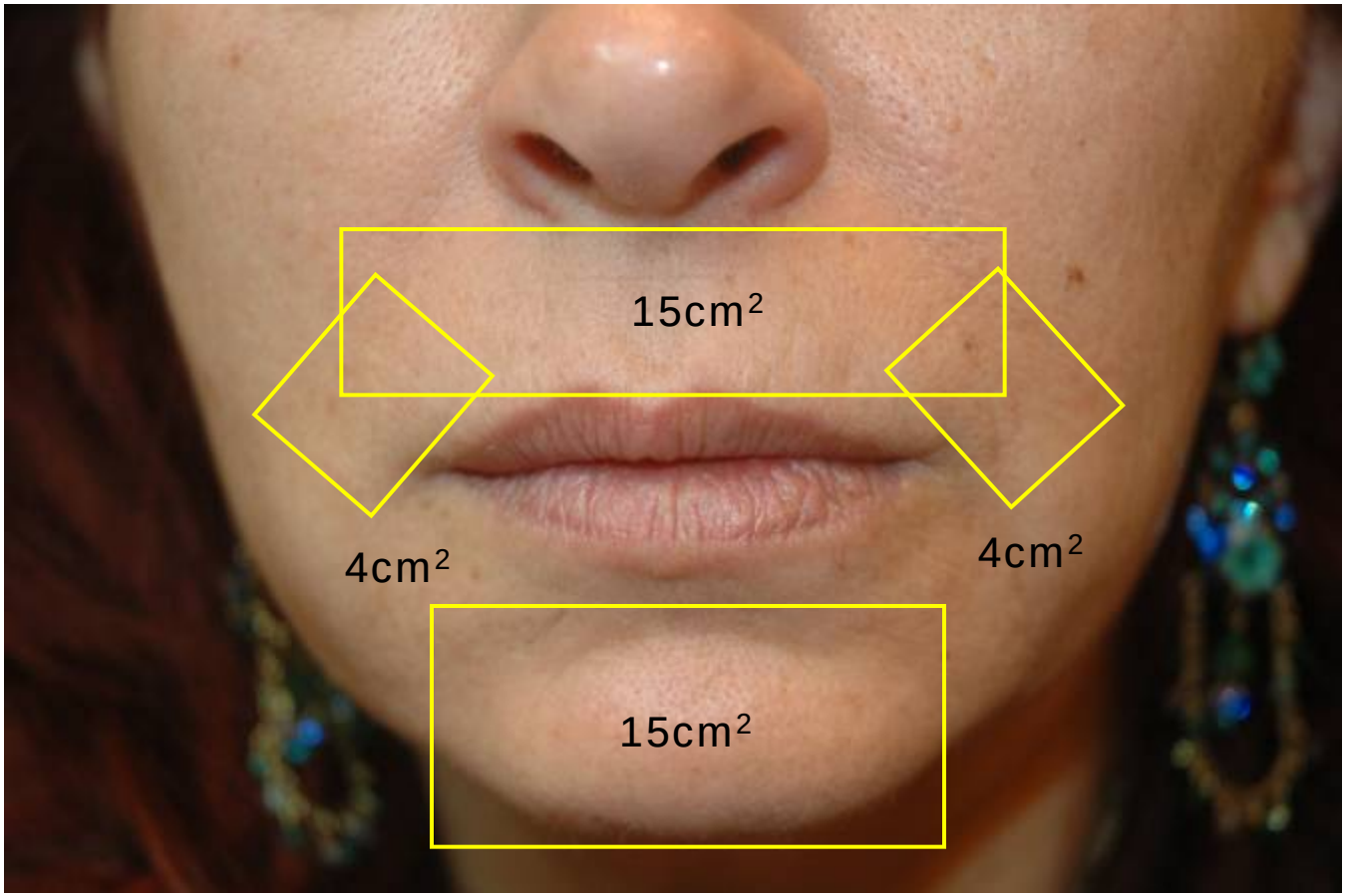
5J/cm^2



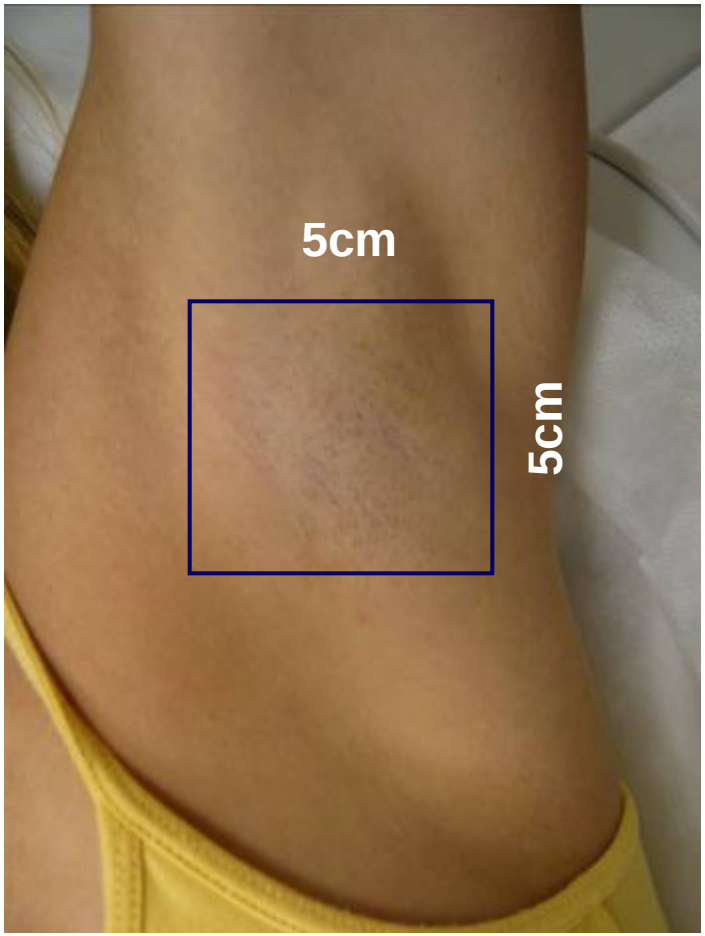
7J/cm^2

6J/cm^2

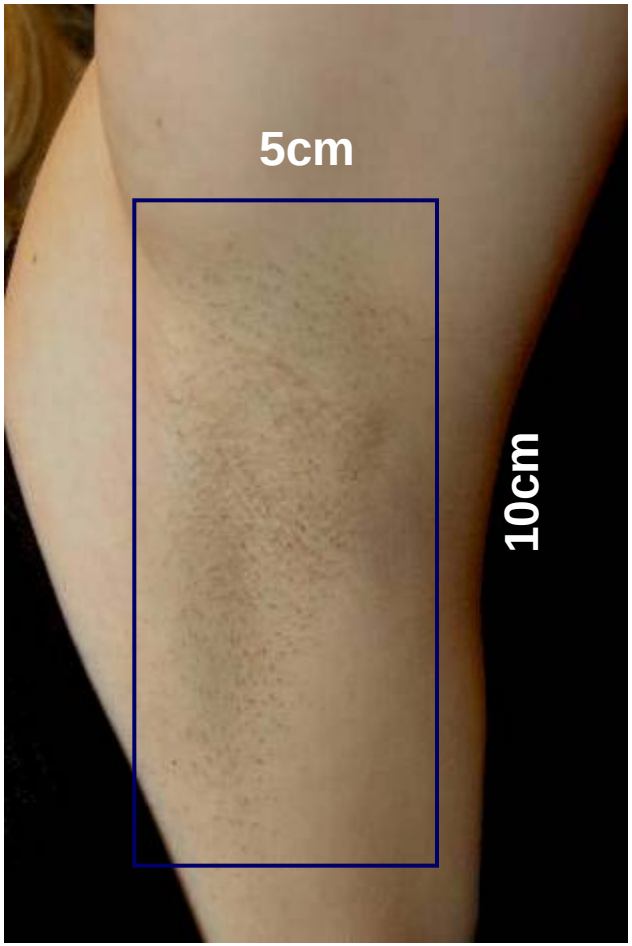
5J/cm^2


15cm²
4cm²
4cm²
15cm²

Stack



Non-stack



Treatment Intervals

Area	Average	Subsequent Txs
Face	Every 4-6 weeks	When re-growth appears (about 2 months)
Body	Every 6-8 weeks	When re-growth appears (about 3 months)

HR Mode


I
II
III
IV
V
VI
32
J/cm2
1
Hz
10
1250

Clinical Publications

Clinical Publications

1. Braun M. Permanent laser hair removal with low fluence high repetition rate versus high fluence low repetition rate 810 nm diode laser – a split leg comparison study. J Drugs Dermatol. 2009 Nov; 8(11 Suppl): s14-7.
2. Braun M. Low Fluence Multiple Pass vs. High Fluence Single Pass Diode Laser Hair Removal - Two Years Post Treatment. ASLMS 30th Annual Conference, April 2010 Poster No. 664
3. Nunes R, et al. Diode laser for permanent hair reduction using SHR volumetric heating technique: 2,448 subjects ASLMS 30th Annual Conference, April 2010 Poster No. 671
4. Trelles MA, Urdiales F, Al-Zarouni M. Hair structures are effectively altered during 810nm diode laser hair epilation at low fluences. J Dermatolog Treat. 2010 Mar; 21(2): 97-100.
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SHR Histology

Trelles MA, Urdiales F, Al-Zarouni M.
Hair structures are effectively altered during 810nm diode laser hair epilation at low fluences
J Dermatolog Treat. 2010 Mar; 21(2): 97-100.

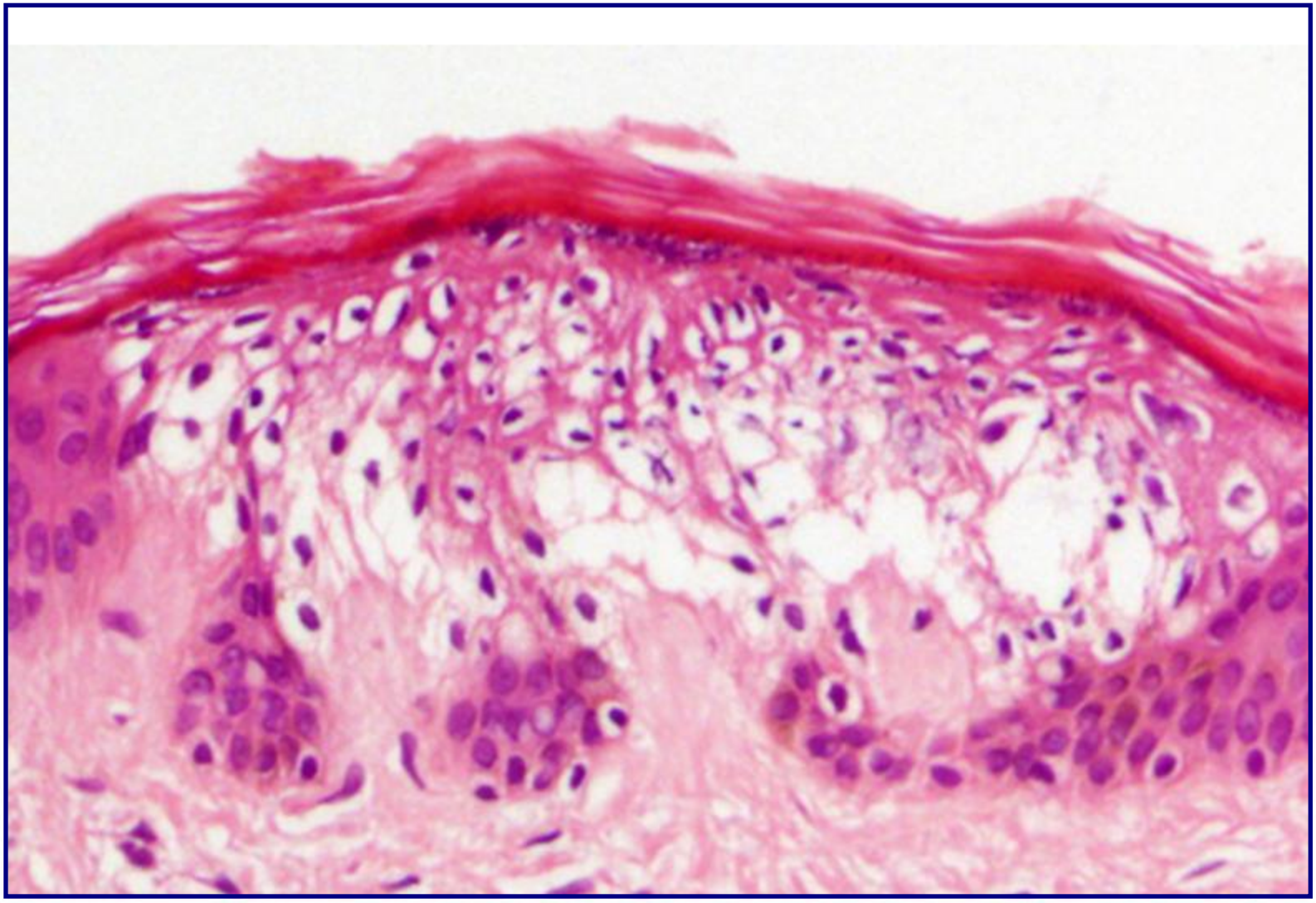


Figure 1: Skin x 125 HE/EO. Cytopathic and vacuole changes at the keratinocyte level are clearly seen.

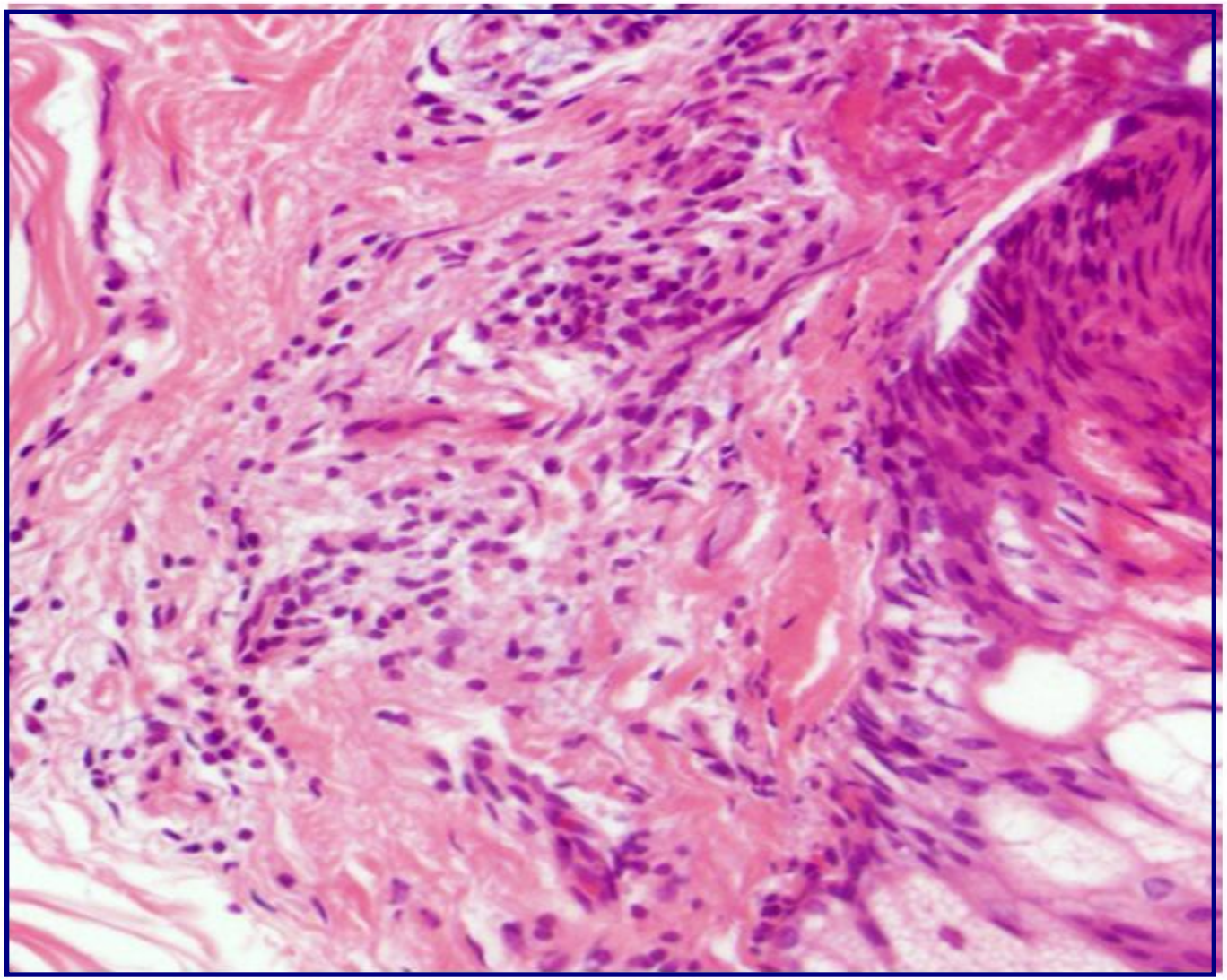


Figure 2: Skin x 400 HE/EO. Perifollicular oedema and peribulb thermal damage, represented by darker staining, and polymorphic nuclear cell inflammatory infiltration are noticed respecting the integrity of the neighbouring tissue.

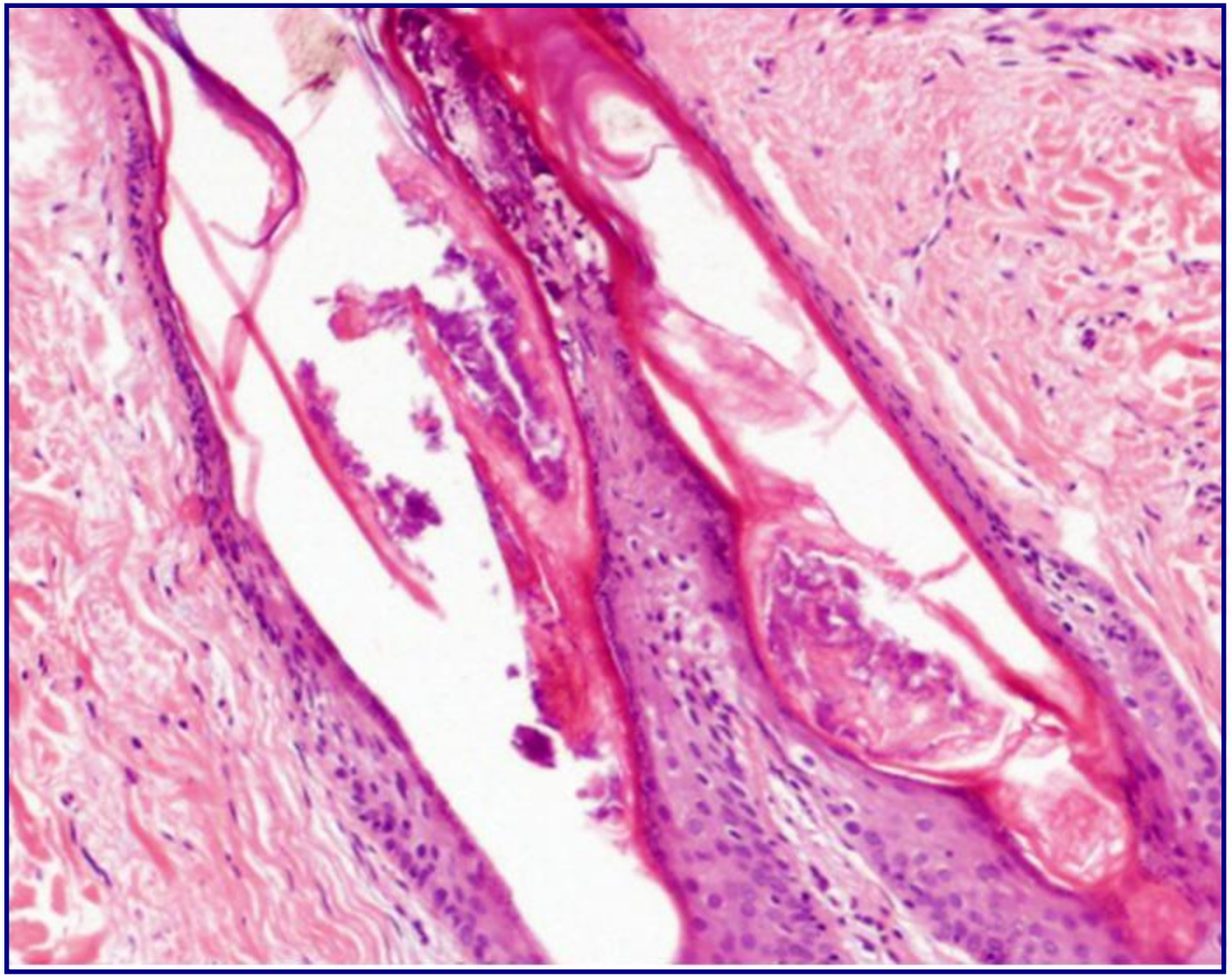


Figure 3. Skin x 250 HE/EO. Images of haemorrhaging are seen in between the collagen fibres at the stroma hair level.

Figure 4: Skin x 400 HE/EO. Perifollicular oedema is clearly noticed as a consequence of thermal effects.

Figure 5: Skin x 400 HE/EO. Presence of hair disruption with detachment from its shaft. Peri-isthmic fibrosis is observed together with inflammatory infiltration.

In-Vivo Histopathologic Assessment of High Average Power Diode Laser for Permanent Hair Reduction Using SHR™ Volumetric Heating Technique

Tania Ap. Meneghel, MD and Maria Leticia Cintra, MD
Renaissance , Medical Center for Prevention and Rejuvenation
Jardim Girassol Americana, São Paulo, Brazil

INTRODUCTION

Laser hair reduction has been used for both aesthetic and therapeutic purposes (e.g., folliculitis). However, hair reduction by means of lasers and light sources such as IPL, using the traditional method, has some disadvantages: pain, formation of erythema, crusting, pigmentary changes, as well as the use restriction in phototypes V and VI. Another obstacle is tanned skin, much appreciated in tropical countries. Thus, there is a widely recognized need for an improved method for laser hair removal that heats hair follicles to a sufficient temperature while delivering an optimal amount of optical energy to thermally alter hair follicle function.

We treated six female patients, age 24 – 45 and Fitzpatrick phototype II to V, for the purpose of permanent hair reduction of bikini line with the Soprano^{XL} laser diode system (Alma Lasers, Caesarea, Israel). The system operates at a wavelength of 810nm, with maximal fluence 10J/cm² at a repetition rate of 10Hz and a spot size of 1.2cm² (average power > 100watt). The handpiece consists of a sapphire with contact cooling. The technique employed was constantly moving the handpiece across a defined area. Volumetric heating is achieved by employing continuous laser exposure on the pre-marked area of 100cm² until reaching a recommended accumulated energy of 10kJ. There is no need for the use of anesthesia. A thin layer of ultrasound gel was applied on the skin to allow smoother sliding of the handpiece at a speed of ~ 5cm/sec. The expected sequelae are edema and perifolicular erythema. Immediately after the procedure, we performed a biopsy of 3.5cm x 1.5cm in the suprapubic region. Another biopsy was taken 7 days later. Skin sections were stained with hematoxylin & eosin (H&E).

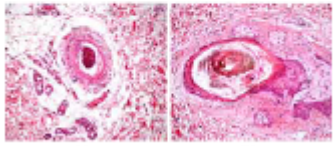
Results

All treated areas of the participants demonstrated the expected clinical end points during and after treatment that are believed to be consistent with clinical efficacy with other devices tested in our clinic. The SHR diode laser therapy resulted in perifollicular edema and erythema, and singed hair was often seen at the skin surface immediately post-treatment. On histology, examining immediately after-treatment, epidermis presented normal configuration and the keratin layer showed no particular changes in all cases. Interestingly, in all the slides follicular hyaline necrosis was observed (Table & Figure 1). Hyaline membrane is a thin, clear basement membrane between the outer root sheath and inner fibrous layer of a hair follicle.

Table 1. Patients' quantitative histopathology assessment immediately and 7 days after treatment

Patient	Age	Skin type	Hyaline necrosis immediately after	Hyaline necrosis after 7 days
DS	35	V	90%	60%
MS	33	IV	90%	50%
RS	33	IV	60%	80%
MAS	45	II	80%	80%
AF	32	III	90%	90%
RP	24	V	80%	60%

Figure 1. Coagulative necrosis and shrinkage of the central components of the hair follicle (a), with epithelial thinning and dilation (b).



(a) (b)

Advanced Diode Laser Technology Using Low Fluence, High Average Power and High Repetition Rate for Virtually Painless, Permanent Hair Reduction

David J. Friedman, MD[1], Ziv Karni PhD[2], Joseph Lepselter PhD[2], LaseOhr Dermatology Clinic, Jerusalem[1] the Biophysics Laser Laboratory Alma Lasers Ltd., Caesarea, Israel[2]

Introduction

Laser hair removal technology emerged and proliferated in the past decade to become the "gold standard" for the treatment of unwanted/ excessive hair. Laser devices (alexandrite, diode, neodymium:YAG and ruby lasers) with high fluence, high peak power and low average power are commonly in use but can be accompanied by high incidents of patient discomfort and low performance-cost ratio. In addition pain, erythema, swelling, pigmentary changes and burned hairs are reported adverse effects. While clinically proven, laser technology for permanent hair reduction has yet to achieve good safety and efficacy standards. There is a widely recognized need for an effective hair removal method which is not accompanied by patient discomfort. We postulate that a hair removal system which heats the hair follicle to a sufficient temperature for hair removal while delivering a minimal amount of thermal energy to the epidermis will be virtually painless and deliver effective results. The purpose of this preliminary study is to summarize the clinical experience gained in the past four months using an advanced diode laser system (Soprano XL, Alma Lasers Ltd, Caesarea, Israel).

Methods

Fourteen patients (8 female; 6 male; 18-37 year-old; Fitzpatrick skin type II-IV; hair color black [n=9]; brown [n=5]; hair type coarse [n=8]; vellus [n=6]) were treated with the Soprano XL diode laser system using the following specifications: wavelength 810nm, fluence 10J/cm², spot size 1.2 cm², repetition rate of 10 Hz. The system handpiece has a sapphire contact cooling tip. Parameters were kept constant for each and every treatment/patient. Group I (n=10) received a laser treatment every 4-6 weeks (number of treatments range 2-5), and Group II (n=4) is in the process of receiving 6 laser treatments on a weekly basis with 1, 3 and 6 months follow-up.

Patients were treated in the following areas: axilla (n=8); stomach (n=3); back (n=2); chest (n=3); arm (n=1). Before the treatment, high resolution photography was taken to document each area (Nikon D70, Japan). All areas were shaved and wiped cleaned. No local anesthesia was used. The treatment technique employed multiple, in-motion, repetitive passes (6-10; average 8 passes) on a pre-marked grid (10 x 10 cm for smaller area and 15 x 15 cm for larger areas). A single grid was used on small areas (axilla, bikini) whereas multiple grids were used on large areas (chest, back, arm). Before the treatment, the grid area was covered with a thin coat of ultrasonic gel. The handpiece (in contact with the skin) was moved within the grid boundaries at a speed of 5 cm/sec employing "paint-brush"-like strokes to cover the entire grid area. This was done repetitively and sequentially 8 times (range 6-10). Clinical end-points were considered as epidermal and perifollicular erythema and edema.

Results

All patients reported virtually no pain (minimal heat sensation) during all treatments. No adverse side effects were recorded during, after or during the follow-up. Group I (n=10) received on average 3.2 treatments. One month after the last treatment, Group I hair clearance score was >75-<100% in the axilla, >50-<75% in the chest, >75%<100%, on the back and arm >50-75%. Group II (n=4) received on average 5.4 treatments. Similarly, one month after the last treatment, Group II clearance score in the axilla was >75% <100%.

Discussion

In the past decade, many laser and pulsed light based devices for removing unwanted hair based on the principle of selective photothermolysis have been introduced to the market, and to date, this hair removal method is in wide-spread clinical use.

During treatment, the skin of the treatment region is locally irradiated by a high fluence and high peak power laser beam, and the melanin-containing hair follicle absorbs the delivered electromagnetic radiation, resulting

In-Vivo Histopathologic Assessment of High Average Power Diode Laser for Permanent Hair Reduction Using SHR®Volumetric Heating Technique

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Renaissance , Medical Center for Prevention and Rejuvenation. Jardim Girassol Americana, Brazil

INTRODUCTION

The laser hair reduction is a desire of human beings both for aesthetic and therapeutic purposes (eg. folliculitis). However, the success of hair reduction by means of diode laser, using the traditional method, has some disadvantages: pain, formation of erythema, crusting, pigmentary changes, in addition to the use restriction in phototypes V and VI. Another obstacle is tanned skin, much appreciated in tropical countries. Thus, there is a widely recognized need for an improved method for laser hair removal which heats the hair follicles to a sufficient temperature while delivering a minimal amount of optical energy to thermally alter hair follicle function.

Method

We have treated 6 female patients (age 24 - 45 years-old) and Fitzpatrick phototype II to V, for the purpose of permanent hair reduction of bikini line with the Soprano XL laser diode system (Alma Lasers, Caesarea, Israel). The system operates at a wavelength of 810nm, with maximal fluence 100/cm at repetition rate of 10Hz and a , spot size of 1.2cm2 (average power > 100watt). The handpiece consist of a sapphire with contact cooling. The technique employed was moving (In-Motion) the handpiece in a fixed area of 100cm². Volumetric heating is achieved by employing continuous laser exposure on the pre-marked area of 100cm² until achieving the recommended accumulated energy of 10kJ. There is no need for the use of anesthesia. A thin layer of ultrasound gel was applied on the skin to allow smoother sliding the handpiece on the skin at a speed of – 5cm/sec. The expected sequeale is edema and perifolicular erythema. Immediately after the procedure, we performed a biopsy of 3.5cm x 1.5cm in the suprapubic region. Another biopsy was taken 7 days after the procedure. Skin sections were stained with Hematoxylin & Fosin (H&E).

Results

All treated areas of the participants demonstrated the expected clinical end points during and after treatment that are believed to be consistent with clinical efficacy with each of the devices tested. Diode laser therapy resulted in perifollicular edema and erythema, and singed hair was often seen at the skin surface immediately post-treatment. On histology, examining immediately after – treatment, epidermis presented normal configuration and the keratin layer showed no particular changes in all cases. Interestingly, in all the slides follicular hyaline necrosis was observed (Table and Histology). Hyaline membrane is a thin, clear basement membrane resides between the outer root sheath and inner fibrous layer of a hair follicle.

Table 1. Patients' quantitative histology assessment immediately and 7 days after treatment

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RP	24	V	80%	60%

NEW TRENDS IN PHOTOEPILATION SOPRANO SHR AND HARMONY SHR.

Dr. Fernando Urdiales Gálvez. Instituto Médico Miramar. Malaga

INTRODUCTION

Photoepilation has become the most popular and most widely used of all medical/aesthetic procedures. This method is undoubtedly the most frequently used, and of greatest demand in Europe. According to data from last year, in the USA, more than three and a half million procedures were carried out. Becoming, this way, the second medical/aesthetic procedure after Botox.

OVERVIEW AND TYPES

From this year up to 2006 industry had offered nothing completely new or revolutionary. It is in 2006 that new systems arise, based on Drs Anderson and Parrish's concept of Selective Photothermolysis - developed in 1983 - but applying low energies and high repetition rates generating what we call "Progressive Photothermolysis". This technological development is now being used with laser systems and intense pulsed light, systems which are produced only by an Israeli company (Alma Lasers, Caesarea Industrial Park). Likewise, great efforts were made to control the architecture of the pulses of the intense light, by means of LEO (Light Energy Optimization) technology through EDF (Equal Distribution of the Fluence) and AFT (Advanced Fluorescent Therapy).

Therefore, we could identify two key concepts on which new technological developments for photoepilation are based:

-**Super Hair Removal(SHR):** It is also called superepilation with reference to repeated and fast emission of pulses of low energy, that progressively heat the chromophores without damaging the skin. This technology is used with Diod Laser systems (Soprano, Alma Lasers) and with Intense Light systems (Harmony XL, Alma Lasers).

-**Light Energy Optimization(LEO):** It is also called optimization of thermic energy, and it is based in turn, on two concepts:

Equal Distribution of Fluence(EDF): So called, with reference to the fact these technologies allow to eliminate the energy peaks emitted per pulse in intense light systems, since those peaks are the cause of unwanted effects such as burns and pain. By using this technology, every pulse that is emitted by the system is made of many micro pulses without emission peaks, so the energy is evenly distributed and best used, which in turn will allow to work with lower fluence, and achieve better results, avoiding the unwanted effects previously mentioned (Fig. 33-1).

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ORIGINAL ARTICLES Journal of Drugs in Dermatology

Permanent Laser Hair Removal With Low Fluence High Repetition Rate Versus High Fluence Low Repetition Rate 810 nm Diode Laser—A Split Leg Comparison Study

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Vancouver Laser & Skin Care Centre,Vancouver, BC, Canada

ABSTRACT

High fluence diode lasers with contact cooling have emerged as the gold standard to remove unwanted hair. However, laser hair removal is associated with pain and side effects, especially when treating dark or tanned skin. A novel diode laser with low level fluence (5–10 J/cm²) with a high repetition rate at 10 Hz (Soprano XL in SHR mode, Alma Lasers, Chicago, IL) using multiple passes in constant motion technique was compared to traditional one pass high fluence (20–60 J/cm²) diode laser (LightSheer ET, Lumenis, Santa Clara, CA) in a prospective, randomized split-leg study on 25 patients with Fitzpatrick skin types I–V. Hair counts were done six months following the fifth treatment and were found to be comparable with a 86-91% hair reduction. There was one superficial burn with the high energy diode treatment. The rapid, multiple pass in-motion technique was faster and associated with significantly less pain. Multiple passes of diode laser at low fluences but with high average power results in permanent hair removal with less discomfort and fewer adverse effects, especially on darker skin.

INTRODUCTION

Laser hair removal has enjoyed substantial popularity, and is presently the second most popular non-surgical cosmetic procedure in the U.S. following botulinum toxin injections.[1]

Laser and light-based techniques rely on the process of selective photothermolysis.[2] The selective absorption of red and near-infrared wavelengths by melanin in the hair shaft and follicular epithelium confines thermal damage to the hair follicles and, to a point, limits the untoward diffusion of excess thermal energy to the surrounding tissue. Laser hair removal was first described in 1987 in an experiment to remove rabbit eyelashes with an argon laser.[3] Subsequently, physicians used the Nd:YAG laser[4] and the ruby laser[5] to remove hair. The alexandrite laser[6] and diode followed;[7] all have been thoroughly described and reviewed.[8] All of these laser systems used the highest fluence possible without damaging the tissue surrounding the hair follicle with a single pass.

The approach of using low fluences with repetitive millisecond pulses to achieve heat stacking in the hair bulb and bulge represents a paradigm shift in laser hair removal methodology. This study compares efficacy, safety and treatment speed of a new low fluence rapid pulse with multiple passes 810 nm diode hair removal modality with a traditional high powered single pass 810 nm laser diode system.

This is the first study designed to evaluate the hypothesis that low level fluences done repetitively on a hair follicle will produce permanent hair removal with less discomfort and fewer side effects than a single high fluence pulse.

MATERIALS AND METHODS

This prospective single-center, bilaterally paired, blinded, randomized comparison study was conducted in accordance with recognized Good Clinical Practice (GCP/ICH) guidelines and applicable regulatory requirements. Thirty-three (33) female subjects (skin types I–V) with hair on the legs who in the opinion of the investigator were viable candidates for laser hair removal were enrolled in the study. These patients were offered five complimentary laser hair removal treatments on their legs as an inducement to enroll in the study. Alma lasers partially funded the cost of the study.

Subjects were to be between 25 and 65 years of age, in good general health with no known photosensitivity or use of medication with photosensitivity as a side effect, no obvious skin disease or history of chronic skin disease other than moderate facial acne vulgaris, no history of keloid or hypertrophic scar formation, and no tattooing in the treatment area. Subjects were excluded if they were pregnant, nursing or unwilling to use birth control during the study period if of childbearing age; had waxed the lower legs or undergone therapy with any radiofrequency or light source; used prescription or over-the-

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Biological and clinical aspects in laser hair removal

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INTRODUCTION: In the past century, unwanted hair has been traditionally treated with multitudes of techniques that were found to be slow, tedious, painful, impractical, and resulted in poor long-term efficacy. Consequently, there has been a public demand for a novel, rapid, reliable, safe, and affordable hair removal technique. In the last decade, laser and light-based technology for hair removal became one of the fastest growing procedures in modern cosmetic dermatology.
OBJECTIVE: To discuss the latest scientific and clinical issues in the field of photepilation as evolved in the past decade: hair biology, laser physics and skin optics, technology and clinical experience.
RESULTS: From substantial clinical experience, it becomes apparent that in the ideal subject with fair skin and dark hair, a single treatment can reduce hair by 10–40%; three treatments by 30–70% and repeated treatments by as much as 90%. These results persist for as long as 12 months. Diffuse and perifollicular cutaneous erythema and pigmentary changes are the most common adverse side effects. Most complications are generally temporary.
CONCLUSIONS: Photepilation, when properly used, offers clear advantages when compared with older, traditional techniques. Although an ever-increasing number of published studies have confirmed the safety and short and long-term efficacy of photepilation, the technology still has limits and risks. (*J Dermatol Treat* (2004) 15: 72–83)

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Keywords: *Anagen — Bulb — Follicular erythema — Hot follicle — Laser*

Introduction

Excess hair and/or unwanted hair are of significant medical, social and cultural importance and are therefore the subject of much attention, manipulation and regard in both genders and all races. The multitude of treatments available is testimony to these facts. Traditionally, conditions such as hirsutism, hypertrichosis, and cosmetic elegance have been treated with electrolysis/thermolysis, tweezing, shaving, waxing and sugaring, plucking, threading, depilatories and X-ray therapy.[1] These methods, however, were found to be slow, tedious, painful, impractical for treating large areas, and, in most cases, temporary. Consequently, the need for a long-term, non-invasive, rapid, reliable and safe method became a necessity in our society.

When first described some 7 years ago, laser hair removal created controversy.[2] As the technology matured, laser hair removal generated growing demand not only for a safe, non-invasive, pain-free procedure, but also for effective, rapid pace, easy to operate, and affordable technology. Today, photepilation by laser and other light-based technology is the fastest growing procedure in modern cosmetic dermatology. As more clinical research and experience is gained in the field of laser hair removal, manufacturers and practitioners have been obligated to seek safer and more effective results.

Although the technology is relatively new, it has already generated much interest among clinicians and patients alike because of its ability to delay hair regrowth, and non-invasively remove large areas of

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No. 671

DIODE LASER FOR PERMANENT HAIR REDUCTION USING SHR VOLUMETRIC HEATING TECHNIQUE: 2,448 SUBJECTS

Rafael Nunes, Daniela Nunes, Guilherme Nunes, Katleen Conceição, Tatiana Yumi
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Summary

Photoepilation is one of the most used in aesthetic treatment in the world. Several laser devices such as Alexandrite, Ruby and Nd:YAG are used for this purpose. This study presents the results of a 3 years experience with diode laser, using volumetric heating with the SHR technology (Soprano^{XL}, Alma Lasers Ltd., Israel) on 2,448 subjects. Subjects were submitted to 6 sessions with 4-6 weeks apart. Follow-up assessments were made with 3 and 6 months after the last session. No side effects were found with the use of this new technology, proving to be safe and with a high subject satisfaction.

Background and Objectives

Diode laser was considered the gold standard for photoepilation but the use of high fluence sometimes are accompanied by complications such as erythema, swelling, pigmentary changes and burned skin (Figure 1 and 2). This study aims to present a 3 years experience with diode laser, using volumetric heating with SHR technology, using low fluence with high repetition rate.

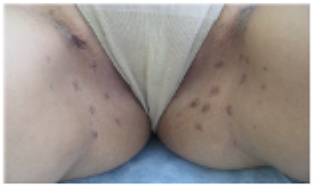

Figure 1: High Peak Energy Diode Laser – Burn and Pigmentary Change
Light Sheer Duet - Lumenis

Figure 2 : High Peak Energy Diode Laser – Pigmentary Change
Light Sheer Duet - Lumenis

Study Design and Methods

2,448 subjects were treated in all skin types (I– VI), in different areas with a 810nm diode laser with 6-10 J/cm^2 fluence, 1.2cm^2 spot size (Figure 3), 10Hz repetition rate (Figure 4). The treatment technique employed multiple in-motion repetitive passes on a pre marked 10cm X 10cm grid, up to 12kJ cumulated (Figure 5). Clinical endpoints were considered as epidermal and perifolicular erythema and edema.

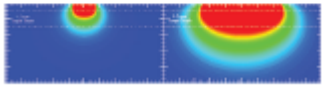

Figure 3: SHR Larger Spot Size – Deep Penetration

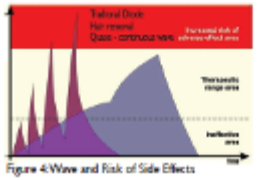

Figure 4: Wave and Risk of Side Effects

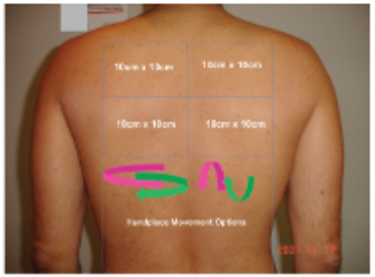

Figure 5: SHR Technique – Low Fluence with High Repetition Rate

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LOW FLUENCE MULTIPLE PASS vs HIGH FLUENCE SINGLE PASS DIODE LASER HAIR REMOVAL - TWO YEARS POST TREATMENT

MARTIN BRAUN, M.D. Vancouver, Canada

Background and Objectives

Laser hair removal (LHR) is the most popular light based therapy in America. High fluence diode lasers with contact cooling have emerged as the gold standard to remove unwanted hair. However, laser hair removal is associated with pain and side effects, especially when treating dark or tanned skin. All of the traditional laser systems used the highest fluence possible without damaging the tissue surrounding the hair follicle with a single pass. Laser and light-based techniques rely on the process of selective photothermolysis. The selective absorption of red and near-infrared wavelengths by melanin in the hair shaft and follicular epithelium confines thermal damage to the hair follicles and, to a point, limits the untoward diffusion of excess thermal energy to the surrounding tissue. The approach of using low fluences with repetitive millisecond pulses to achieve heat stacking in the hair bulb and bulge represents a paradigm shift in laser hair removal methodology. A novel diode laser with low level fluence (5-10 J/cm^2) with a high repetition rate at 10 Hz (Soprano SHR by Alma Lasers, Chicago) using multiple passes in constant motion technique was compared to traditional one pass high fluence (25-40 J/cm^2) diode laser (Lightsheer ET, Lumenis, Santa Clara) in a prospective, randomized split-leg study on 25 patients with Fitzpatrick skin types I-V. The results 6 months following the final treatments were presented at the 2009 ASLMS annual meeting in Washington, and published (Braun, M. Permanent laser hair removal with low fluence, high repetition rate verses high fluence, low repetition rate 810 nm diode laser – a split leg comparsion study. J. Drugs in Derm. Nov. 2009 Vol. 8 Issue 2.) This poster reports results two years following LHR on 22 of the original 25 patients.

Study Design and Methods

This prospective single-center, bilaterally paired, blinded, randomized comparison study enrolled 33 female subjects (skin types I–V) with hair on the legs who in the opinion of the investigator were viable candidates for laser hair removal. These patients were offered five complimentary laser hair removal treatments performed every 6-8 weeks on their legs as an inducement to enroll in the study. One leg of each patient (randomly determined) was treated with the Soprano diode laser using a technique of maintaining the hand piece in constant motion, fluence up to 10 J/cm^2, 10 Hz, 20 ms pulse duration. With the constant motion technique, an area of about 200 sq. cm was treated with 6-10 multiple passes. The operator never remains stationary in one spot, and is always moving the laser hand piece on the entire 200 sq. cm. area, similar to ironing. By using this technique, the skin is never subjected to a single diode laser pulse greater than 10 J/cm^2. Since this is below the threshold of burning, the incidence of adverse effects should be lower, as well as the sensation of discomfort which is directly related to fluence. The purpose of the study was to evaluate the degree of discomfort using this constant motion technique and the amount of permanent hair reduction. With six month post-treatment hair counts, the efficacy of the low fluence-multiple pass technique could be compared to standard high fluence laser hair removal. The other leg was treated with the Lightsheer diode laser using a conventional single pass, fluence to tolerance (20-50 J/cm^2), 2 Hz ,30 ms pulse duration. The single pass parameters were aggressive so that there could be no criticism that the leg treated with the high fluence had inadequate energy.

Results and Conclusion

Of the original 33 patients enrolled in the study only 25 completed the five LHR treatments. 7 patients were dismissed from the study for failure to adhere to the 6-8 week re-treatment schedule; one patient left the study due to a laser burn on the high fluence treated leg which healed without any residual complication. Two years following the initial treatment (18 months following the fifth and final LHR) 22 patients returned to have their hairs counted; three could not be contacted. The hairs within a one sq. inch grid were photographed and counted by an independent university student prior to the first treatment, 6 months following the 5th treatment, and 18 months following the 5th treatment. (Figure 1)

Figure 1 : Digital Photographic Hair Counts

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Clinical Evidence

Before

After 4 Tx

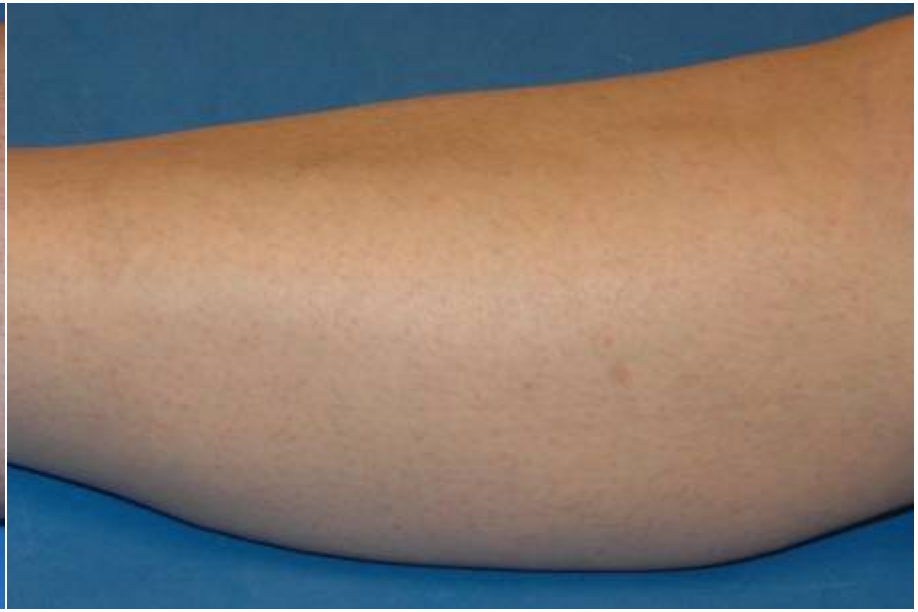
Before

After 5 Tx

Before

After 5 Tx

Before



4 weeks After 3 Treatments

Before

6 weeks After 2 Treatments

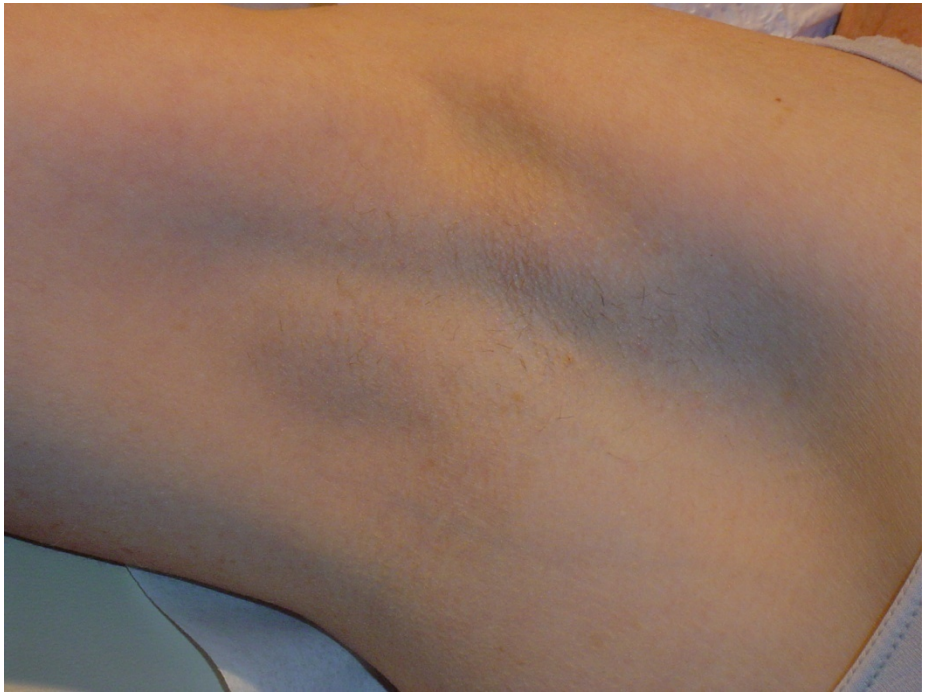
Photos Courtesy: Kyle Holmes, M.D.
Davis Laser Center, CA. USA

6 month after 7 Tx.

Photos Courtesy: Kyle Holmes, M.D.
Davis Laser Center, CA. USA

6 month after 5 Tx.

Photos Courtesy: Kyle Holmes, M.D.
Davis Laser Center, CA. USA



6 month after 6 Tx.

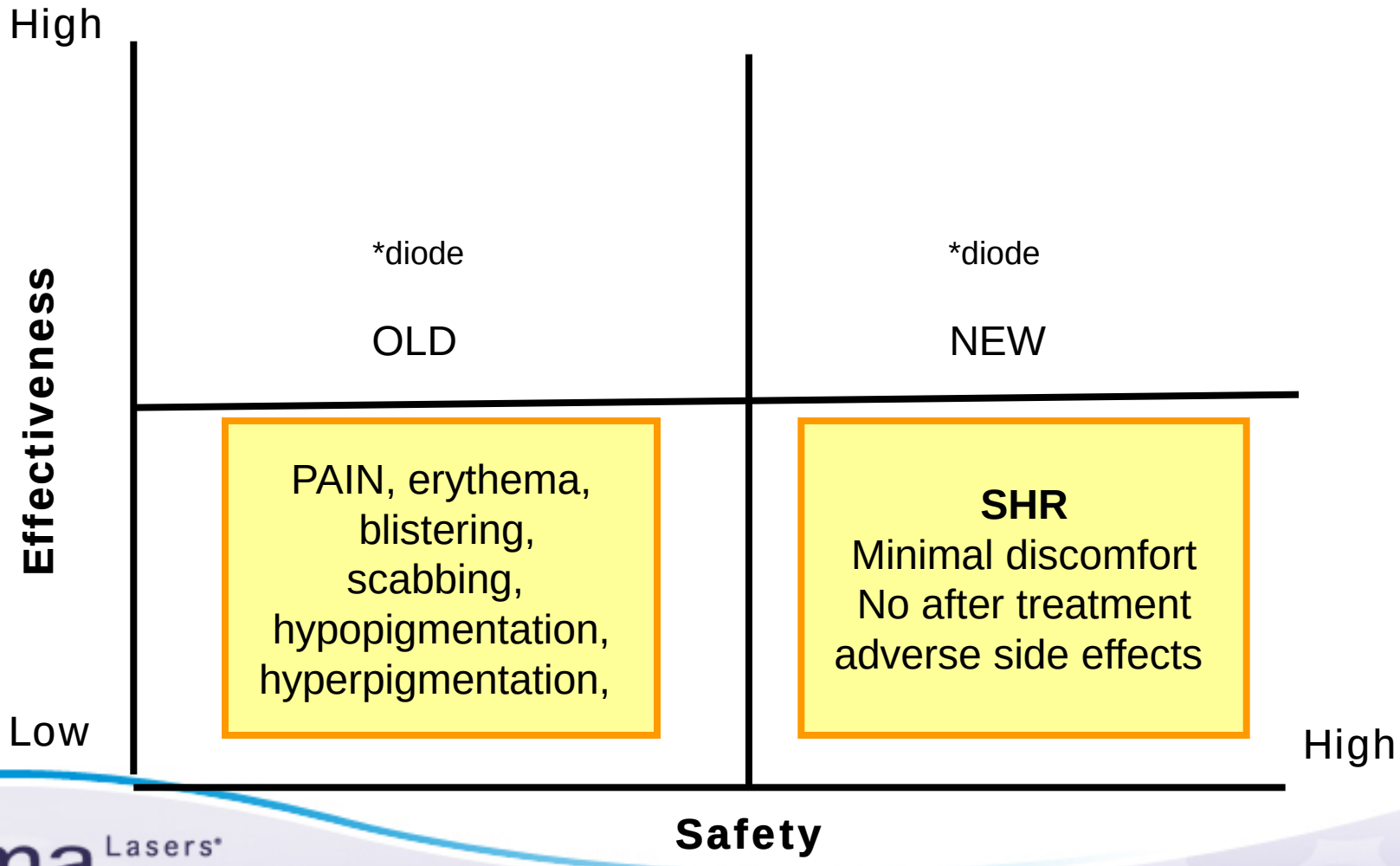
Photos Courtesy: Kyle Holmes, M.D.
Davis Laser Center, CA. USA

6 month after 5 Tx.

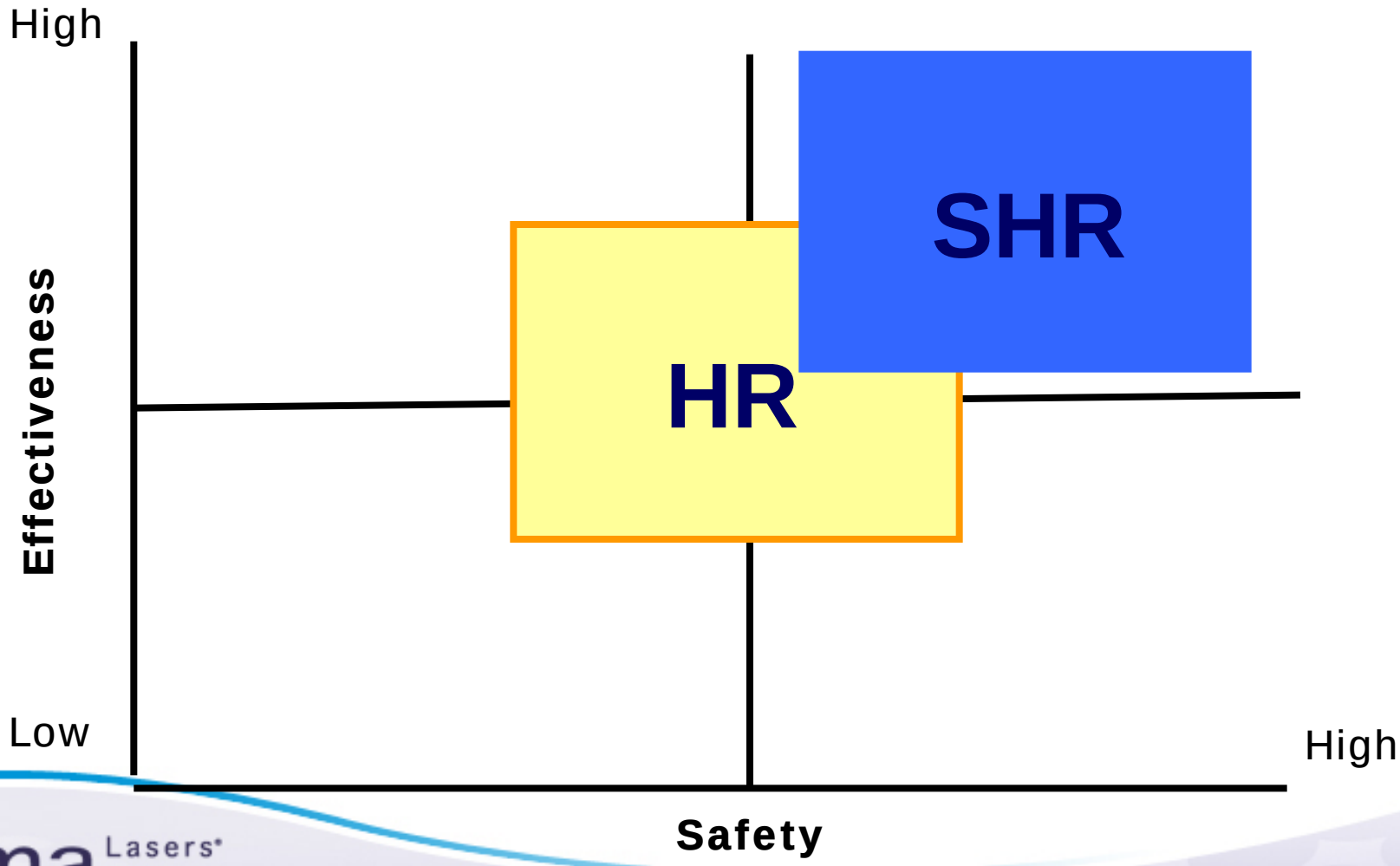
Photos Courtesy: Kyle Holmes, M.D.
Davis Laser Center, CA. USA

6 month after 3 Tx.

SHR Safety*


High
Effectiveness
Low
*diode
OLD
*diode
NEW
PAIN, erythema, blistering, scabbing, hypopigmentation, hyperpigmentation,
SHR
Minimal discomfort
No after treatment adverse side effects
High
Safety

SHR vs HR



SHR - Summary

1. Minimal pain
2. Similar efficacy to gold standard technologies
3. Treat all skin types; very safe
4. Year long procedure
5. No disposable
6. Ease of use – In Motion procedure


Caesarea Old-Port BC 22