

Innovations in Burn Scar Treatment

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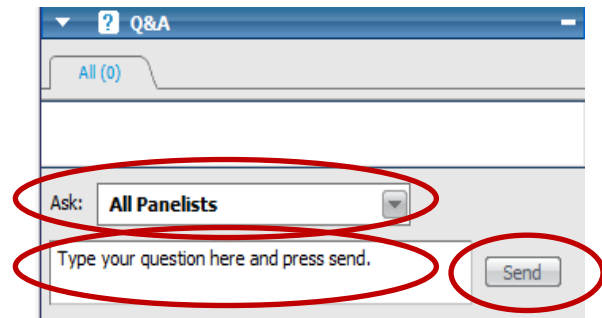
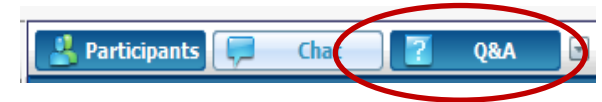
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Jeffrey Saffle, MD, Medical Director Paradigm Outcomes

Laurie Anderson, Vice President, Clinical Operations, Paradigm Outcomes

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Burn Scar Management

Why is this necessary?

Scar management is necessary to:

1. Improve, stabilize and maintain range of motion and function
2. Improve skin quality, reduce itching and discomfort, and prevent ulcerations
3. Improve self-image, facilitate community and residential re-integration

Today's Webinar Objectives

Our conversation centers on three primary goals.

1. Identify the two types of *lasers* routinely used for burn scar treatment.
2. Describe the *time course* of laser treatment for burn scars.
3. Describe how lasers should be *utilized* in scar treatment *after* burn injury.

Our Presenter



Dr. Jeffrey Saffle

Paradigm Medical Director

- MD with specialty in burn surgery and rehabilitation
- Served as director of the Burn-Trauma Intensive Care Unit and director of the Department of Telemedicine for the University of Utah Health Center
- Past chairman of the American Burn Association's Multicenter Trials Group and currently serves on the Medical Advisory Board of the Shriners Hospitals of North America
- Recipient of the University of Utah Distinguished Teaching Award, as well as the American Burn Association Harvey Stuart Allen Award.



Innovations in Burn Scar Treatment

Dr. Jeffrey Saffle

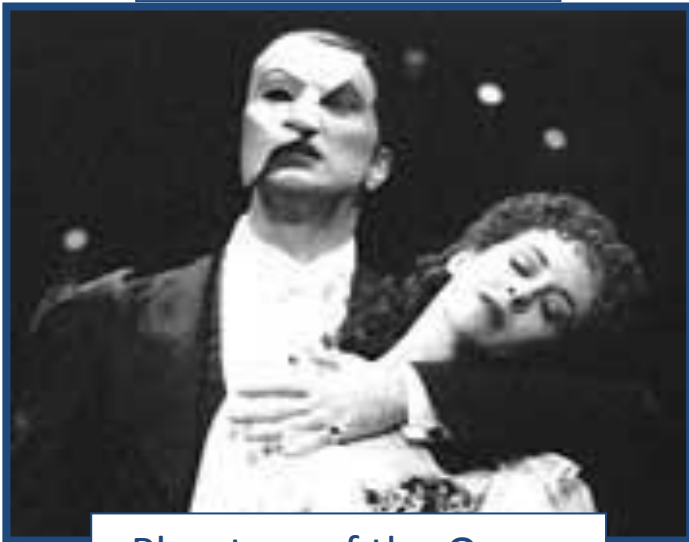
Burn Victims in Popular Culture



Freddy Krueger



Darth Vader



Phantom of the Opera



The Man without a Face

Wound Healing

Three Stages:

1. *Inflammation* (Begins immediately):

- Release of vasoactive amines and cytokines
- Increased blood flow
- Continues throughout the healing process
- Scars are “mature” when the redness goes away

2. *Proliferation* (Days to months):

- Fibroblasts/myofibroblasts
- New blood vessels
- Collagen synthesis
- Re-epithelialization

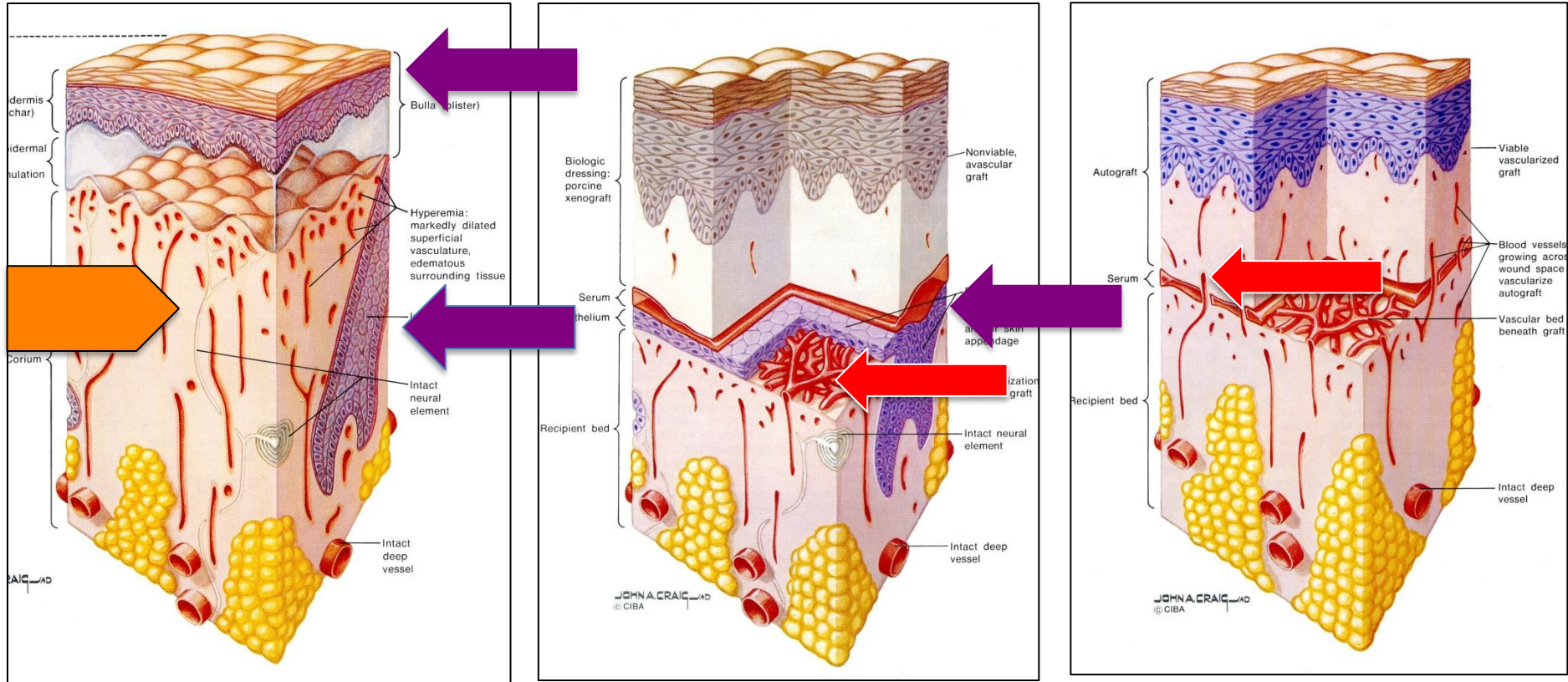
3. *Maturation/remodeling* (Weeks to years):

- Collagen cross-linking is revised
- Wounds contract
- Erythema resolves
- Scars soften
- Takes at least **A FULL YEAR!**

Wound Healing

- Even in normal wounds, remodeling takes ***at least 12 MONTHS***
 - Scar maturation can be measured (roughly) by erythema
- Healing occurs by ***CONTRACTURE***
 - Scars are always under tension
- Dermis ***does not regenerate***
 - It's replaced by scar tissue
 - ***The more dermis left in the wound, the less scarring***
- In general, ***the better the skin graft***, the less the resulting scar
 - Full-thickness > split-thickness > mesh > CEAs
- Once scars are mature, they cannot be affected much by ***therapy or stretching***
- Whenever you ***remove a scar***, you leave another scar in its place
- Scarring is idiosyncratic and ***UNPREDICTABLE***
 - Affected by age, race, genetics

Partial Thickness Burn Wound



Netter medical illustration used with permission of Elsevier. All rights reserved.



WARNING

**Graphic images
ahead!**

Partial Thickness Burn Wound



Traditional Methods of Burn Scar Management

1. *Compression Garments*

How they work:

Scars grow in response to pressure; compressing them theoretically reduces hypertrophy.
May cause local hypo-perfusion .

Pros:

- Non-invasive
- Some patients like the support

Cons

- Expensive and hard to fit
- Uncomfortable– especially in the heat!
- Require replacement and care
- Stigmatizing
- Compliance a BIG problem
- Abnormal bone growth (Children)
- Pressure is hard to apply in many places (flexor surfaces)



Evidence: Controversial

Compression Garments



Traditional Methods of Burn Scar Management

2. *Silicone Gel/Sheets*

How they work:

Unclear → Increased heat? Hydration? Increased oxygen tension? Polarized electric charge? Immunomodulation?

Pros:

- Non-invasive; economical
- Adhesive patches good for hard-to-compress areas
- Can be customized to small areas; used under garments
- Reduces itching; comfortable

Cons

- Prolonged use is required
- Clammy/hot and uncomfortable
- Can't treat big areas easily

Evidence: Moderate effect on scar hypertrophy, elasticity in uncontrolled trials.

Silicone Gel/Sheets



Traditional Methods of Burn Scar Management

3. *Steroids*

How they work:

Direct reduction in inflammation, immune response, proliferation

Pros:

- Topical cream can be used at low concentrations
- Concentrates treatment to very specific areas
- Effective as part of surgical excision
- Really helps itching, dryness

Cons

- Painful– often requires anesthesia
- Injections are hard to do
- Only small areas can be treated
- Multiple treatments required; response is slow
- Toxicity
- Skin atrophy/depigmentation

Evidence: Good, especially for small, localized scars

Other Methods of Burn Scar Management

4. *Excision and Closure/Grafting*

- Removes scars effectively but new scars can form
- Excellent for ulcerated/unstable scars and contracture
- Expensive, invasive surgery; may need repeating
- Works best on mature scars– that means waiting

5. *Scar Massage*

- Very comfortable; helpful in loosening scars, improving ROM

6. *Moisturizing Lotions*

- Greatly improves comfort/itching
- Facilitates exercise/ROM

7. *Cryotherapy*

- Not much data

8. *Cytotoxic Drugs (5FU, mitomycin)*

- Mostly for keloids

9. *LOTS of Others*

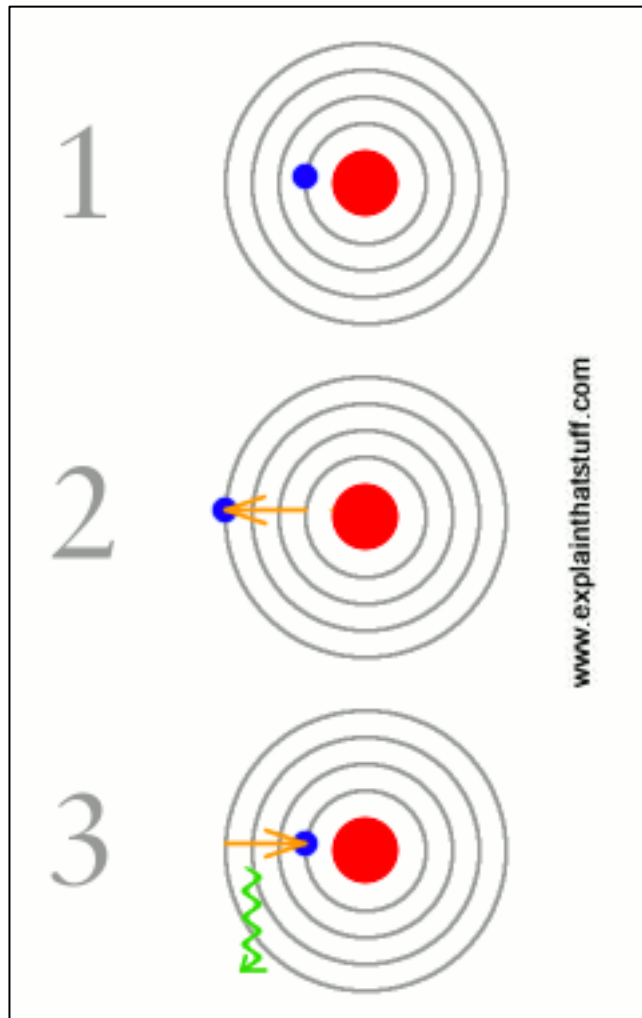
- Aloe vera, Vitamin E, ultrasound, etc.



Severe Hypertrophic Scar

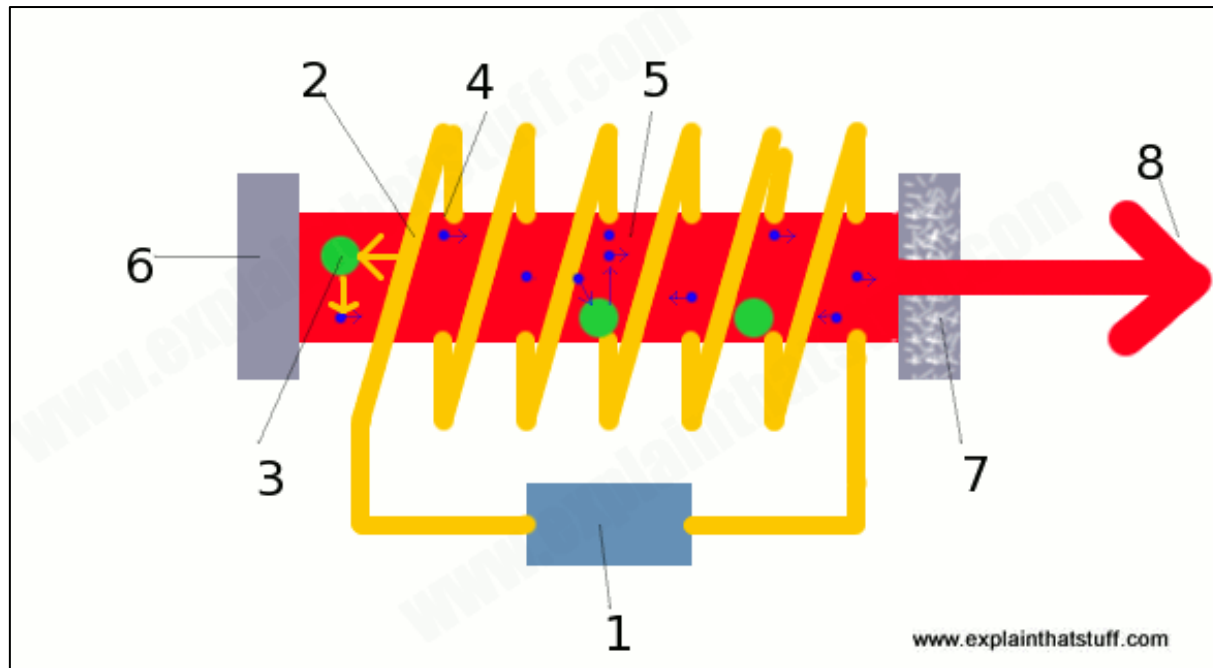


How Do Lasers Work?



When energy hits an atom, an electron is excited and moves to an outer orbit. But this unstable orbit decays and the electron returns to its orbit, releasing the stored energy as a photon of light.

Light Amplification by Stimulated Emission of Radiation



- Electric energy (**1**) is applied through the coil (**2**) as a pulse.
- This excites atoms (**green 3**) to release photons (**blue 4**) which travel through the medium.
- When an photon hits an atom it releases TWO photons (**5**), thus “stimulated emission”.
- The photons bounce back and forth by mirrors (**6**) at either end, eventually exiting through a hole in the end mirror (**7**), producing a light ray of single wavelength and direction.

Lasers Commonly Used in Burn Scar Management

1. *Pulsed-Dye Lasers*

- 585-595 nm wavelength corresponds to oxy-hemoglobin
- Energy is absorbed by capillaries, reducing erythema and producing local hypoxia, platelet activation, histamine release
- Not ablative, applied as a contiguous beam
- Great for ITCHING

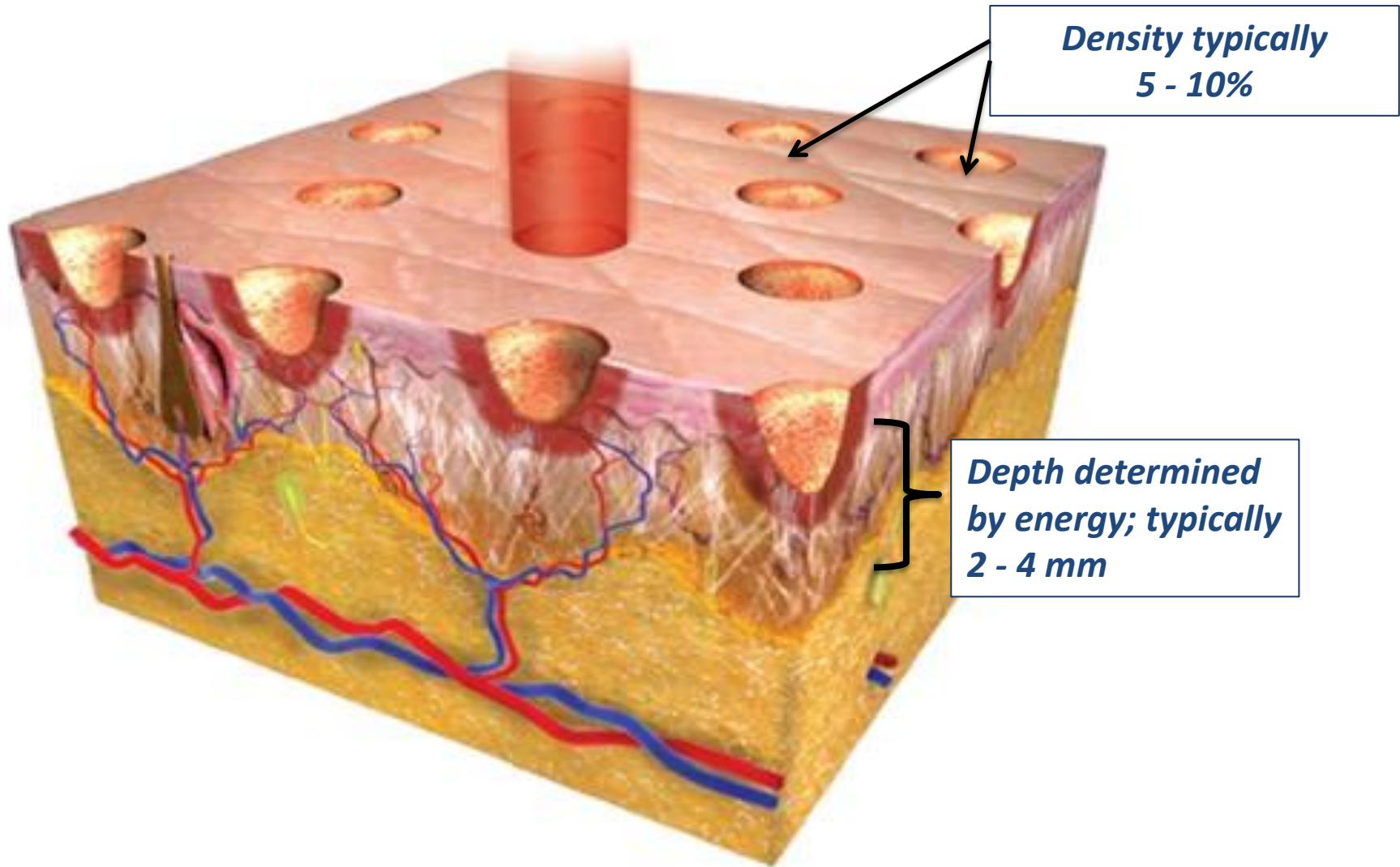
2. *Fractional Ablative Lasers (CO₂)*

- 10,600 nm wavelength
- Produces a narrow column of tissue destruction which closes WITHOUT scarring
- Used for scar density, hypertrophy
- Probably better for mature scars
- Produces some relaxation of scar tension by allowing wounds to expand
- Applied as a matrix of tiny wounds, a “fraction” of total skin area (usually 5-10%)

3. *Alexandrite Laser*

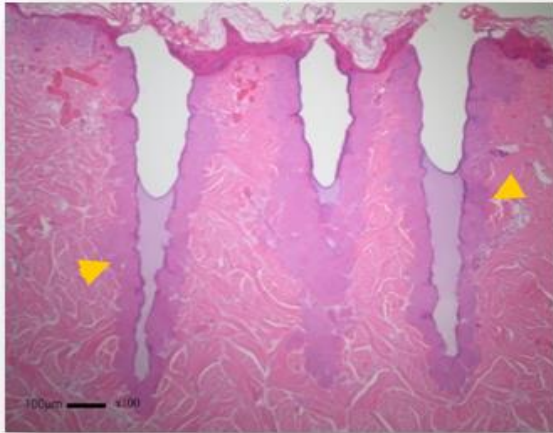
- To destroy hair follicles and sweat glands

Ablative Fractional (CO₂) Laser



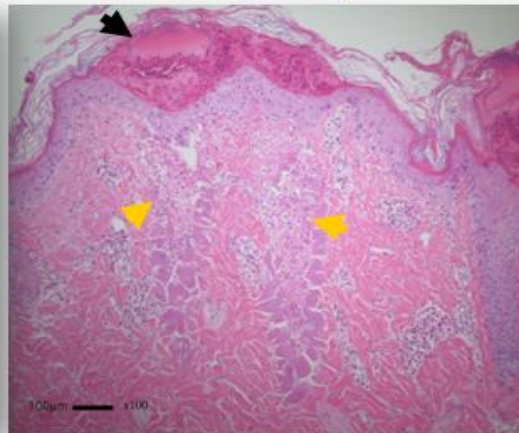
Skin Regeneration Process After Fractional CO₂ Laser

Immediately After Laser



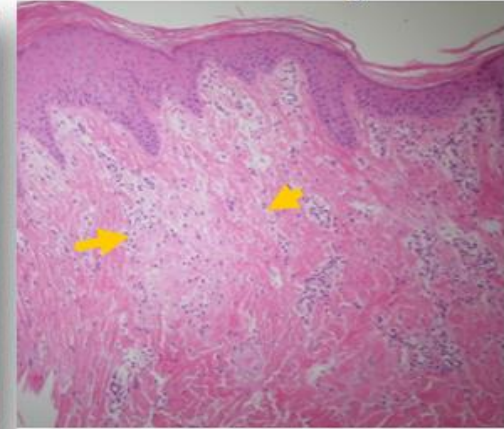
- Ablated epidermis and dermis

Post 2 days



- Re-epithelialization and
- collagen synthesis

Post 14 days



- Complete epidermal regeneration
- Continuing collagen synthesis

Fractional Lasers



Photo courtesy of Dr. Robert Sheridan, Shriners Hospital, Boston

Fractional Lasers



Photo courtesy of Dr. Robert Sheridan, Shriners Hospital, Boston

Laser Treatment Study

“Laser resurfacing and remodeling of hypertrophic burn scars: results of a large, prospective, before-and-after cohort study with long-term follow-up”

-Hulman, CS, Friedstat, JS, Edkins, RE, Cairns, BA, Meyer, A, Annals of Surgery, 2014;260:519-32

- 147 patients
- Mean age 26.9
- Mean burn 16.1%
- Laser treatments as early as 6 months after injury to many years
- Treatments every 6 weeks until patient and physician agreed that results had plateaued.

- Used 595-nm pulse-dye laser for erythema/edema and CO2 laser for texture, thickness, stiffness
- Mean area treated 100 cm²
- Evaluated with Vancouver Scar Scale
- Follow-up out to 36 months

Laser Treatment Study

Vancouver Scar Scale

Pigmentation	Vascularity	Pliability	Height
0 normal	0 normal	0 normal	0 normal
1 hypopigmentation	1 pink	1 supple	1 < 2mm
2 hyperpigmentation	2 pink to red	2 yielding	2 2-5 mm
	3 red	3 firm	3 > 5 mm
	4 red to purple	4 banding	
	5 purple	5 contracture	

Higher scores are worse

Max = 15

Laser Treatment Study

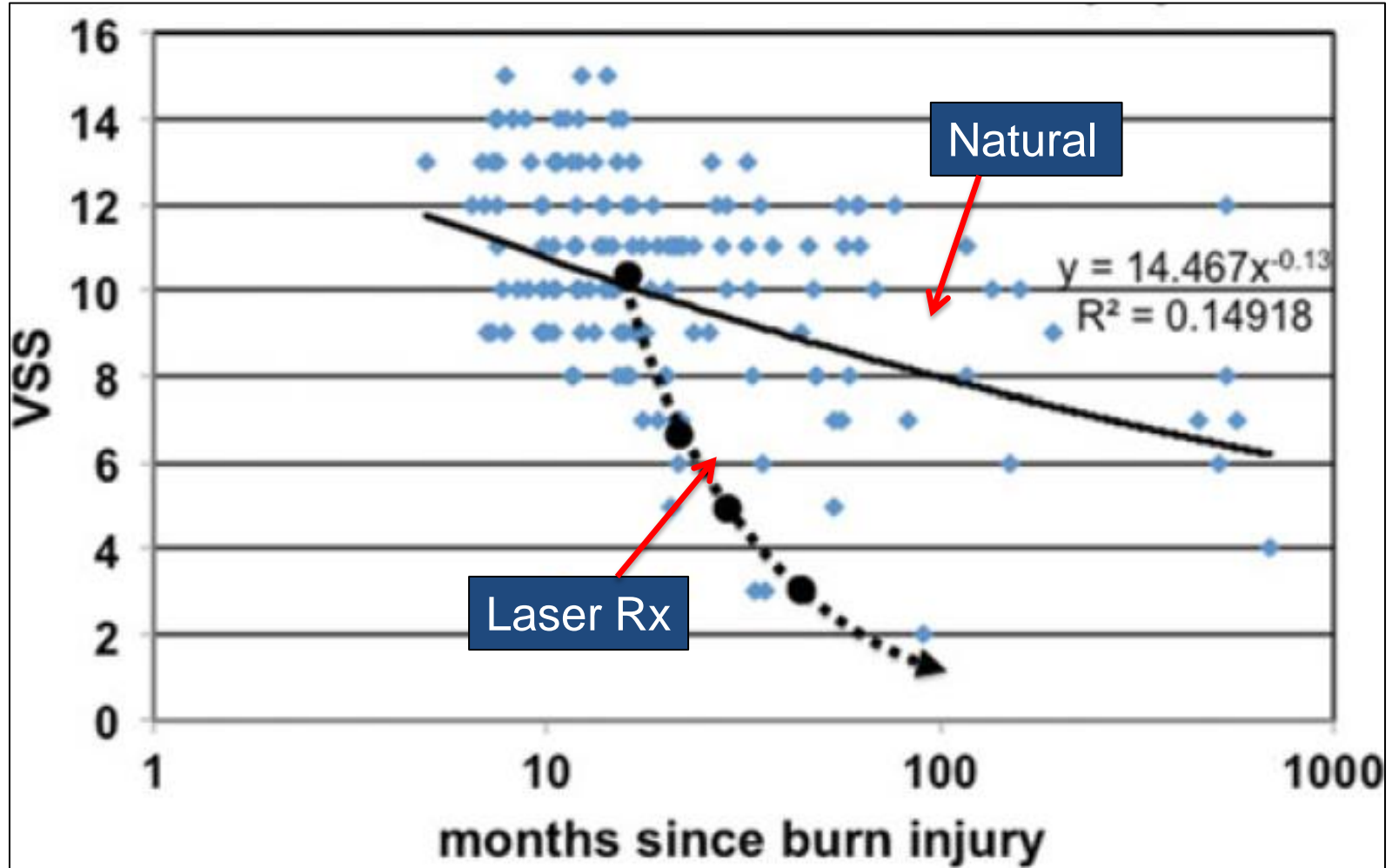
Results

Time	Pre-Op/Baseline	1 Session	All Sessions	Final Result
No pts	147	147	147	35
Scar scale	10.43 ± 2.4	6.67 ± 2.1*	5.16 ± 1.9*	3.29 ± 1.3*

*P < 0.001

Vancouver Scar Scale

As a function of time after burn injury



Source: Hultman et al, Ann Surg 2014;260:519

Laser Treatment Study

Patient Satisfaction

Score 1-5; 5 is highest; n = 25

- Laser treatments resulted in improvement: **4.78 ± 0.42**
- Satisfied with the experience: **4.88 ± 0.34**
- Question: “If you were given a million dollars and could keep the balance, how much would you be willing to spend to completely eliminate your burn scars?”

Answer: **$\$331,308 \pm 425,773$**

- Question: “How much would you pay to get the actual results you got?”

Answer: **$\$220,356 \pm 353,816$**

- Therefore, “*success*” = $220/331 = 66.4\%$



Case Study



**17 female, 50% TBSA burn, PDL x 5, CO2 x 3
Shown 39 months after treatment**

Case Study

Laser PLUS reconstruction



25 male, skin grafted, PDL x 2, CO2 x 3 plus steroid injections
Shown at 37 months



Source: Hultman, CS et al, Ann Surg, 2014;260:519

Case Study



**19 female, s/p grease burn to chest with
sheet grafting. PDL x 2; CO2 X 2
Shown at 22 months**

Source: Hultman, CS et al, Ann Surg, 2014;260:519

Laser Treatment of Burn Scars

Complications/Risks of Ablative Fractional Lasers

- Pain
 - Often done under topical anesthesia, facilitated by relative anesthesia of scar tissue
 - Sedation/general anesthesia is required for larger areas and children
 - Topical cold application may help
- Pinpoint bleeding/purpura
- Serous discharge requiring ointments/dressings
- Itching/discomfort for several days
- Hypopigmentation
- Increase in scarring/keloids
 - Avoid by using low treatment density (< 10%) & depth and by spacing out the timing of treatments
- Infection
 - Usually superficial, less than 1%
- Contraindicated for CEA's, active infections, open wounds
- Most of the worst complications are ANESTHETIC



Source: Adapted from Anderson et al, JAMA Derm, 2014;150:187

Laser Plus Reconstruction



Photo courtesy of Dr. Robert Sheridan, Shriners Hospital, Boston

Laser Therapy for Prevention and Treatment of Pathologic Excessive Scars

1. Meta-analysis of published studies:
 - **829** articles reviewed
 - **28** valid studies met criteria; **919** total patients
 - Burns included in only **8** (4 were “NA”)
2. Overall response for laser:
 - **71%** for scar prevention
 - **68%** for hypertrophic scar treatment
 - **72%** for keloid treatment
3. Data suggested **5 - 6 weeks** is best interval for treatment
4. 532 PDL and 585 PDL had the best **response** rates
5. Better **response** in light-skinned people

What Do You Need to Know About Laser Treatment of Burn Scars?

- It works.... Most of the time **(60-70%)**
- It's use should probably be **SELECTIVE** and part of a **comprehensive** program of scar management: moisturizers, garments, Steroids, therapy
- **Evaluation** should be performed after grafting/healing, perhaps as early as 6 weeks post-injury, but may not be until months later. May continue after outcome is reached. **Treatment isn't "over" until scars are mature.**
- **Predicting** its use will depend on:
 1. Patient healing factors
 2. Scar location (face, hands, torso)
 3. Age and race
 4. Psychological issues
 5. Physician/unit philosophy: **Ask!**

What Do You Need to Know About Laser Treatment of Burn Scars?

- Can be used effectively *years after* the injury
- Multiple treatments are likely to be required: *average of 4-6*
 - Not less than 6 weeks apart
- *Anesthesia* will be needed, possibly general anesthesia
- You can't treat the *whole body*
- Cost: *\$500 – 3,000* for an office “treatment”
 - Can be a lot more depending on number of treatments
- Use your influence to see that it's done at *COMPREHENSIVE* burn/wound treatment center, by *PHYSICIANS*

What Do You Need to Know About Laser Treatment of Burn Scars?

- What does the *future* hold?
 - This is “*the threshold*”
 - “I use them on *everybody*”
- Expect:
 - **MORE** patients
 - **SOONER** post-burn
 - **BIGGER** areas
 - **PROPHYLACTIC/PRE-EMPTIVE** use
 - Use may continue **FOR YEARS**



Laser Hope for “Napalm Girl” 43 years on from Vietnam Attack



“So many years I thought that I have no more scars, no more pain when I’m in heaven.

But now- heaven on earth for me!”

-Kim Phuc Phan



Laser Hope for “Napalm Girl” 43 years on from Vietnam Attack



Phuc has found new hope, thanks to fractional ablative laser therapy. Dr. Jill Waibel, a board-certified dermatologist in Miami, says the treatment, which was initially developed to reduce wrinkles, can help burn and trauma patients heal their scars.

"We're literally going to steam the scar tissue away," she said. "And those little, tiny holes where we vaporize the scar, the body will heal as normal skin."



Case Management Considerations

Laurie Anderson

Case Management Considerations

What should case managers and claims professionals consider?

- Have the appropriate ***medical and rehabilitation professionals*** been identified?
- Has the ***rehabilitation and treatment plan*** been outlined?
- What types of scar treatment will ***provide the greatest benefit*** to the injured worker?
- Will laser treatment ***optimize*** the medical outcome, ***improve*** function and ***promote*** psychological adjustment?
- Is a ***qualified physician*** performing the laser treatment?
- Are there any ***contra-indications*** for laser treatment?
- Does the injured worker have ***realistic expectations*** for laser treatment?
- Have the ***goals and specific objectives*** of laser treatment been established and documented by the treating physician?

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<https://www.surveymonkey.com/r/burnscar>

Tip: If your work computer has blocked Survey Monkey, access the link via your home computer.

Question and Answer Session

Submit your questions in the Q&A panel on the right of your screen.

Dr. Jeffrey Saffle



Laurie Anderson



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