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skin & AGING

Shedding Light on New Technologies

Leading international experts offer candid, often controversial, opinions about the best uses for and viability of state-of-the-art laser, light and other energy sources in cutaneous surgery.

HMP Communications

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Introduction

Each year, for the past 15 years, we've offered a seminar that stimulates a candid discussion of state-of–the-art topics regarding the use of laser, light and other energy sources in cutaneous surgery. Known as Controversies and Conversations in Cutaneous Laser Surgery, this conference showcases a faculty of distinguished international experts who crisply present their views, followed by an active open, spirited, lively, no-holds-barred discussion with other gurus, attendees, medical laser representatives, and guests. This 3-day symposium offers a unique opportunity to discuss controversial topics and current issues in a congenial and collegial atmosphere.

This kind of conference is valuable because new instruments, wavelengths and energy sources emerge every year. Reliable information about these treatments usually lags months to years behind aggressive marketing, and each new development has proponents and opponents, enthusiasts and skeptics. Needless to say, the claims and disclaims that follow the announcements of new devices are often contradictory.

These gatherings have always been stimulating, exciting and enjoyable, and the information and opinions that emerge are essential to all who use lasers or other energy sources in their practice. Information from this yearly gathering narrows the gulf between the everyday realities of patient care and overly enthusiastic advertising claims and information only much later found in journal articles and textbooks.

We are pleased that a summary of some of the presentations and discussions from the August 2004 meeting held at Mt. Tremblant, Quebec, is being presented in *Skin & Aging*. We think you will find it informative and of significant practical benefit.

(Next year's meeting will take place at the BroadMoor Resort in Colorado Springs from August 12 to 14.)

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The Fairmount Hotel in Mount Tremblant, Quebec, Canada, was the beautiful setting for this year's Controversies and Conversations conference.

Aminolevulinic Acid Photodynamic Therapy

Not just for actinic keratoses anymore.

Michael Gold, M.D., Brian Zelickson, M.D., Arielle Kauvar, M.D.

About 4 years ago, 5-aminolevulinic acid photodynamic therapy (ALA-PDT) made a name for itself as an up-and-coming treatment for actinic keratoses. Since then, research has shown the treatment is effective for a broad range of dermatology problems, from photoaging to sebaceous gland hyperplasia. That, along with strategies to reduce the side effects of ALA-PDT, has dermatologists excited about the growing potential of this therapy to treat a broad array of dermatological conditions.

How ALA-PDT Works

There are currently two current topical photosensitizers for cutaneous PDT applications: 5-aminolevulinic acid (5-ALA) and the methyl ester of ALA (mALA).

Epithelial cells absorb these lipophilic compounds and metabolize them into protoporphyrin IX (PpIX), a very potent photosensitizer. PpIX, which is the precursor of heme, accumulates in the membranes of lysosomes and mitochondria in epidermal cells. It also accumulates in pilosebaceous units.

Intense light delivered to treated areas excites PpIX into a triplet state, which leads to cellular destruction. Sufficient levels of light photobleaches PpIX, eliminating toxicity.

PpIX is maximally activated at 409 nm. Other peaks where absorption occurs include 509 nm, 544 nm, 584 nm and 635 nm.

Studies have shown that 410 nm gave greatest effect for superficial/2 mm of skin. Red light is typically needed to go activate ALA beyond 2 mm.

> In a split-face study, an 80% improvement to photodamaged skin was seen on the side treated with ALA/PDT.

What's New with ALA-PDT Treatments

In the original application protocol, ALA was applied for a 14- to 18-hour drug incubation period followed by 16 minutes 30 seconds of blue light. That long incubation period led to significant unwanted photosensitivity — the "PDT effect" — swelling, erythema, crusting and pain. Side effects could last up to a week and cause discomfort

Today, new shorter incubation times have been instituted, decreasing patient inconvenience and side effects. Research has shown, for example, that a 1-hour incubation period can be as effective as a 14- to 18-hour incubation period.

Studies have shown that 20% ALA takes 3 to 4 hours to form protoporphyrin-IX in superficial basal cell carcinomas. With nodular basal cell carcinomas, it can take 11 to 12 hours.

Today, ALA-PDT is filling a niche for field type actinic damage, actinic keratosis, large superficial basal cell carcinomas, and actinic cheilitis, photoaging, acne and more.

New Applications for this Exciting Technology

While ALA-PDT was originally approved to treat actinic keratoses of the face and scalp, the therapy has been successfully used to treat other conditions.

■ ***Acne.*** This therapy requires a total of two to four treatments performed every other week. Initial studies have shown ALA-PDT to be effective in treating both face and trunk acne,

This patient underwent five treatments for chronic actinic damage and actinic keratosis. Treatments included application of ALA for 30 minutes followed by IPL. Photographs courtesy of Mark Nestor, M.D., Ph.D.

with a decrease of up to 60% in inflammatory acne lesions and improved texture changes.

Research also showed that topical ALA photodynamic therapy decreased sebum production for 20 weeks after one to four treatments. The therapy also showed acute and chronic changes to the sebaceous glands.

■ ***Basal and squamous cell carcinoma.*** ALA/PDT is still inferior to surgical excision and Mohs micrographic surgery. Refinements such as enhancement of drug penetration and the use of wavelengths that penetrate deeper into the dermis, however, may improve outcomes.

■ ***Photorejuvenation.*** Drs. Ken Arndt, Jeffrey Dover, and Ashish Bhatia performed a split-face study sponsored by DUSA to test the effectiveness of ALA/IPL vs. IPL alone.

In the study, 20 people received a total of six treatments (three split-face treatments that were 3 weeks apart). Half the face was pre-treated with ALA followed by IPL (the Quantum SR) and half was treated with IPL alone. Patients were evaluated for global photodamage, mottled pigmentation, fine lines, tactile roughness and sallowness on a scale of 0 to 4. Each patient assessed his or her own skin, and a blinded observer saw every patient on every visit. There was 100% compliance in the study.

The results are as follows:

• ***Photodamage*** — 80% improvement on the ALA/PDT side vs. 50% on the IPL alone side.

• ***Mottled pigmentation*** — 95% improvement on the ALA/PDT side vs. 65% on the IPL alone side.

• ***Fine lines*** — 55% improvement on the ALA/PDT side vs. 20% on the IPL alone side.

• ***Tactile roughness and sallowness*** — There was no noticeable improvement between the two sides after treatment

This patient's extensive actinic keratoses and photodamage were treated with a 1-hour application of ALA followed by IPL at 2.4 msec - 4.0 msec pulse, 10 msec delay, 32 J/cm^2. Photographs courtesy of Mitchel Goldman, M.D.

This patient underwent treatment with ALA/PDT with resulting dramatic improvement to her acne.

New Indications for ALA-PDT

- Field AKs
- Large superficial BCCs
- Actinic cheilitis
- Photorejuvenation with ALA "boost"
- Inflammatory acne (as an alternative to medical therapy).

Types of Light Used with ALA-PDT

A broad range of light types are being used to activate ALA. Here's a summary of the most common types of light and their uses:

- IPLs and PDLs, Red Light
  - Photorejuvenation
  - Associated AKs
  - Acne
  - Sebaceous gland hyperplasia
  - Hidradenitis suppurativa
- Blue Light
  - Actinic keratoses
  - Acne

The Pros and Cons of ALA-PDT Treatment

PROS

- Short contact
- Broad area
- Shortened treatments
- With IPL ALA only about three treatments are needed
- Targeted treatment specific to lesion
- Skin usually heals within a week or so (other topical products to treat AK may take four to six weeks and even extend it for downtime and redness), and ALA/IPL rejuvenation patients have very little downtime
- Useful cosmetic benefit
- Relatively noninvasive
- Excellent cosmetic results
- Multiple lesions can be treated simultaneously
- Multiple uses

CONS

- Reimbursement and cost of treatments problem: CPT codes
- Bulky tumors may need multiple treatments and curretting prior to treatment to get light to base of treatment
- Waiting time for photosensitizer to penetrate lesion (one to four hours)
- Photosensitivity may last up to 48 hours
- Expenses

when compared to baseline scores.

In addition, patients tolerated the ALA well with no reports of swelling, no pain, and a tiny bit of crusting.

Strategies to Limit the Effects of ALA-PDT

Here are several strategies that dermatologists can use to target areas that are affected by ALA-PDT. The following three strategies prevent the body from converting ALA into PpIX:

• Cooling. Because ALA does not convert PpIX below 21 degrees C, cooling skin through using techniques like contact cryogen can block the conversion process.

• Chemical inhibition. ALA dehydratase can be inhibited by using a molecule that stops the conversion process.

• Oxygen saturation. Changing oxygen saturation by removing oxygen from the skin can block the conversion process.

Future Questions

One of the biggest questions will be what will be the optimum light source for activating ALA.

No one knows yet. There might not even be just one light source that's optimum.

Presently, multiple lasers and light sources are being used to activate ALA. Techniques include pulsed dye and KYP lasers, noncoherent light sources such as flashlamps, light emitting diodes, tungsten filaments, xenon arcs, metal halides and fluorescent lights.

What we do know is that ALA/PDT appears promising for treating many varied conditions.

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Monopolar Radiofrequency vs. Bipolar Radiofrequency vs. Infrared Lasers

What Is New?

Michael Kaminer, M.D., Brian Biesman, M.D., A. Jay Burns, M.D., and Whitney Tope, M.D.

The good news is that radiofrequency (RF) devices and infrared (IR) lasers are improving. As one physician explained, while studies several years ago showed that only about 30% of patients responded to this therapy, anecdotal case reports indicate that number has been reversed and that 70% or more of patients now respond to this therapy. One challenge for dermatologists, however, remains making sure that patients have realistic expectations about these therapies so they're not disappointed when a face tightening procedure fails to produce the same results as facelift surgery.

How These Devices Work

The key to RF technologies is Ohm's Law and the principle of impedance. Radiofrequency energy heats tissues by creating electric fields between two electrodes, which in turn produce a heating effect. Monopolar electrodes use a rapidly changing charge (up to 6 million times/second) from positive to negative, alternately attracting and repelling electrons and charged ions. The tissue's natural resistance to movement produces heat, which in turn denatures collagen as well as triggers the body's natural wound healing response.

In contrast, light-based sources target a specific chromophore within the body, such as water. Penetration of light, and consequently, the ability to produce heat, is physically limited by the wavelength of the light and light's natural tendency to scatter within tissue.

Three devices are on the market that implement these technologies:

1. Monopolar (Thermage): Using current treatment tips and capacitively coupled radiofrequency, this device heats about 2.5 mm, or deeper if desired, beneath the skin surface. (1/4 sq. cm. tips heat about 1 mm to 1.25 mm beneath the skin surface). Heating takes place above and below that, but that's where the concentrated effect is.

2. Bipolar (Syneron): This 900 nm diode laser causes nonspecific tissue heating, followed by conductively coupled RF energy in targeted tissue areas. Heating is shallow and occurs at about 1.5 mm.

3. IR (Cutera): Infrared light source (1,100 nm to 1,800 nm) provides thermal heating at unknown depths.

How New Treatment Guidelines Are Improving RF (Thermage)

■ ***Multiple passes.*** **This is the key phrase here.** Using up to five passes, or more if needed, at moderate level settings produces better and more consistent results with less discomfort and fewer side effects.

The goal is to treat at moderate level settings calibrated to patient feedback on heat sensation.

This patient underwent treatment with Thermage. At left is the pre-treatment photo, and on the right is the patient 1 month post-treatment. Photos courtesy of Flor Mayoral, M.D.

Treat to a desired endpoint of visual tightening:

- 300 to 400 or more / 1.5 cm radiofrequency energy pulses (REPs) for two initial XY passes of mid and lower face
- 40 to 80 REPs for additional XY tightening
- 60 to 120 REPs for Z-axis, inward contouring passes
- Always use skin marking grid paper
- Alternate passes between in the grid square and at the intersection of the grid lines
- Avoid overlapping REPs or pulse stacking.

Increased REPs:

- Current treatment guidelines allow up to five passes while dermatologists initially used 150 REPs for a full face with a 1-cm tip at one pass, they now can do 400 to 600 REPs with a 1.5-cm tip.
- Thin to moderate skin / younger to middle age patients (under age 65 with only modest sagging) tend to respond better.

New Techniques Are Giving RF Procedures a Boost

Several new techniques have made a difference in the ability of RF to tighten skin:

■ ***Treat to observable endpoint.*** Look for visible changes instead of blasting the face and trying to achieve overall improvement.

■ ***Take a three-dimensional approach.*** In addition to looking at patients on the traditional X and Y dimensions, look for the Z dimension, which refers to an inward shrinking (an event that is difficult to see on photographs). Pay attention not only to the overall number of passes, but where they're placed.

Patient Discomfort

While these treatments are still not entirely sensation-free, the degree of discomfort can be mitigated by using lower treatment levels and more passes. Experts say that a single pass at high energy is not only more painful, but less effective. More REPs at lower treatment levels are less painful and more effective.

It appears best to use patient feedback on heat sensation as an indicator of the effectiveness of this treatment. Treatment levels can be determined by patient tolerance. If the procedure becomes too uncomfortable, the treatment level should be reduced.

To avoid sedating patients at all, some dermatologists are experimenting with extremely low treatment levels. One physician uses a setting of 61, which can be tolerated by most patients with three or four passes.

Until such low treatment levels become the standard, experts suggest a combination of the following pain medications to help patients undergoing RF treatment:

1. Topical anesthetic (optional)
2. Ativan (orally) an hour before
3. IM Demerol.

Experts noted that treating physicians need to avoid giving patients too much pain medication or total anesthesia that will entirely block patient ability to provide feedback on heat sensation. In fact, many dermatologists say their patients report preferring to undergo RF procedures with

This patient underwent treatment with Thermage. At left, she's pictured before treatment. On the right is the patient 2 month post-treatment. Photographs courtesy of Robert Weiss, M.D.

The patient pictured at left (pre-treatment) underwent treatment with Thermage. On the right, she's pictured 6 months post-treatment. Photographs courtesy of Flor Mayoral, M.D.

This patient had great results with Thermage, which you can see at right where she's pictured 6 months post-treatment. The photo on the left is before treatment. Photographs courtesy of Mark Nestor, M.D.

This patient experienced dramatic results with Thermage.
At left is before treatment; at right is 2 months post-treatment.
Photos courtesy of Kim Schuchardt, P.A. (Richard Neils, M.D.).

no topical anesthetic.

Patients relate that without pain relief, they can feel cooling techniques take effect. With a topical anesthetic, patients can't feel the cooling, which may result in more pain.

Managing Patient Expectations to Avoid Disappointment

Experts say that dermatologists need to take the lead in helping set and manage patients' expectations. And a key step, they say, is to explain that facial skin tightening via RF and IR laser therapies is not the equivalent of a surgical facelift and should not be positioned as such. Making the analogy to a surgical facelift sets the stage for patient disappointment.

Counsel patients to expect the minimum you think you can provide, not the fantastic results you may have seen in a handful of patients. Explain that results can be modest.

In addition, RF and IR laser therapies are not as effective for photoaging and wrinkles. For these changes, other approaches are needed such as laser resurfacing or non-ablative skin rejuvenation.

On the plus side, the therapies don't have the same downsides and costs as facelift surgery.

Some experts caution against relying on results after 5 days post-treatment. Some tightening and improved appearance that appears in the short term (a week or two) doesn't always persist for several months. Most, however, expect the maximum effect 4 to 6 months after the treatment.

Non-indications: RF and IR laser therapies are not currently indicated for muscular effects, platismal bands, dynamic wrinkles, nasolabial folds and deep net lines.

Potential Problems with RF and IR For Skin Tightening

- Pain
- Rare indentations
- Treatments can be tedious and time-consuming.
- Patient expectations can be unrealistic.
- Some systems can be unwieldy and difficult to use on the face.

Surface Irregularity Problems

In the past, some patients experienced surface irregularities because of overly aggressive treatment level settings and / or anesthetic approaches.

It is hypothesized that irregularities occur when thermal injury occurs as a result of overheating in both fat lobules and fiber septa. If problems occur, they tend to appear 2 to 4 months after treatment and may be permanent.

The good news is that the incidence of problems is 0.15% of patients treated. About 30% of reports of depressions occurred in patients using topical anesthesia; 70% were when local, regional or general anesthesia or blocks were used.

To prevent these types of problems, the evidence suggests using lower treatment levels. Finally, by using patient feedback on heat sensation as an indicator, overtreatment can be prevented.

Depressions sometimes resolve themselves, usually in a matter of months. Some have been successfully treated by autologous fat transfer, but limited follow-up data exist on this strategy.

Future Indications for RF (Thermage)

These include abdomen (post liposuction or pregnancy), arms, acne, cellulite, eyelids, thighs, knees and hands.

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Light and Lasers For Acne

Not the standard of care, but a good alternative or adjunct for some patients.

Thomas E. Rohrer, M.D., Edward Victor Ross, M.D., Brian Zelickson, M.D.

The debate about whether light and lasers can effectively treat acne received some new attention earlier this spring when researchers from the University of Michigan concluded the 595 nm pulsed dye laser was ineffective in treating the disease.

While an earlier study published in the *Journal of the American Medical Association*, showed significant improvement of acne with the pulsed dye laser, the new study showed no evidence of improvement. However, other recent studies using different laser devices have shown dramatic improvement in acne. Researchers acknowledge that while they aren't ready to declare lasers and light therapy the standard of care to treat acne, the treatments can help patients who don't respond to or can't follow medical therapy.

Here is a review of the pros and cons of laser and light treatment for acne, and a look at what years of research, not just one study, has found about the value of the therapy in treating acne.

The Mechanism: How Lasers and Light Therapies Combat Acne

Light and laser treatments may target either *Propionibacterium acnes* or the sebaceous gland.

Lasers and light sources that emit wavelengths in the visible light spectrum (400 nm to 700 nm) take advantage of the Q-band absorption peaks (500 nm to 700 nm) of porphyrins released by *P. acnes*. When exposed to light, porphyrins produce free radicals, causing bacteria to self-destruct.

> The *JAMA* study found no significant differences between skin treated with lasers and untreated skin.

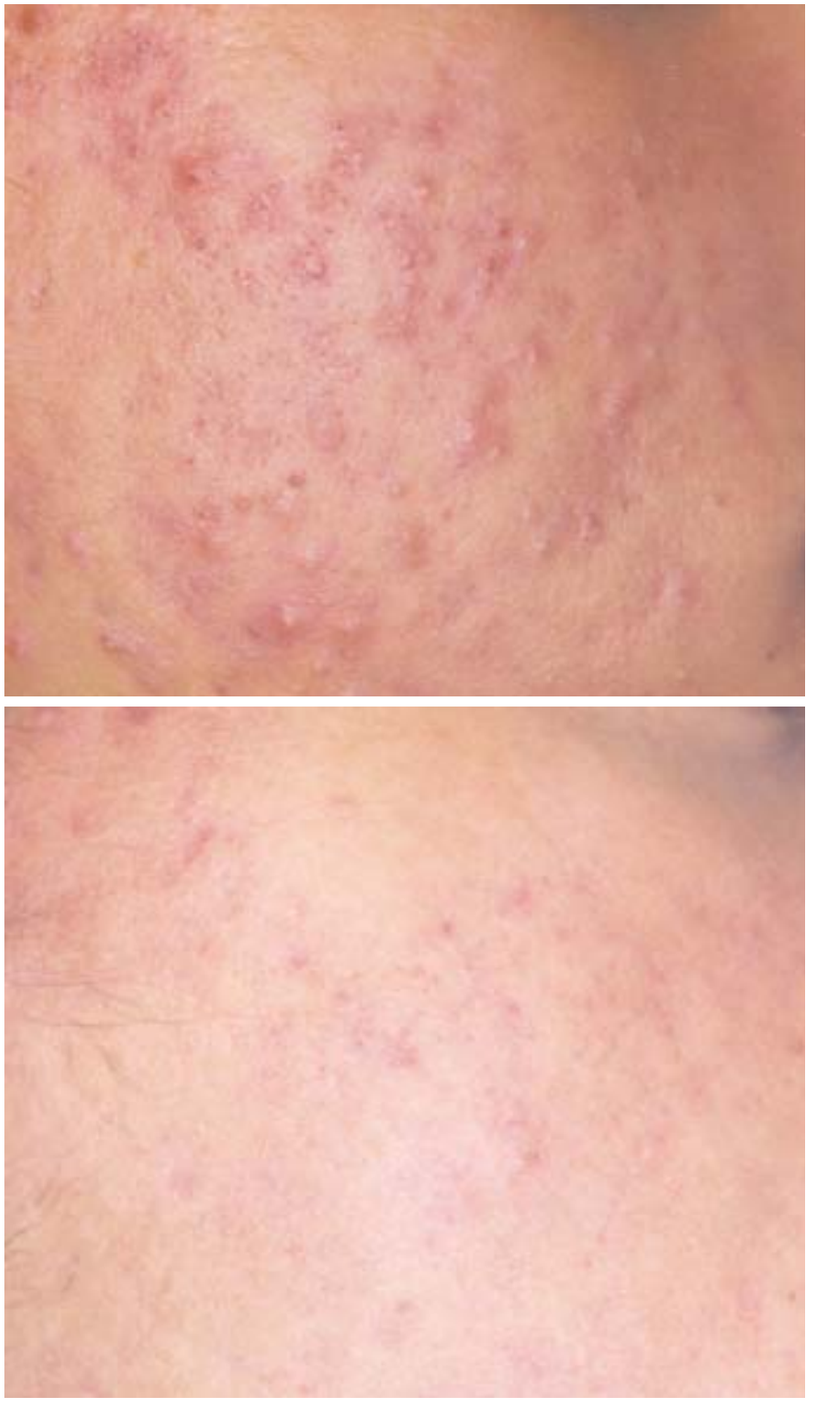
The infrared lasers may also make small changes in the infra fundibular region, which some experts refer to as ground zero for acne. Changing this area allows sebum to more easily escape the sebaceous gland.

Experts maintain the best approach to acne with lasers and light sources is to treat the sebaceous gland and not just the *P. acnes*. Targeting the sebaceous gland may offer long-term acne clearing. Targeting *P. acnes* will likely result in temporary improvement. Likewise, the entire area that potentially gets acne should be treated, not just active lesions. Treating active lesions will at best temporize acne severity.

Experts also say that mild and moderate acne can typically be treated with visible light in combination with medical therapy. More severe inflammatory acne with light skin type and scarring typically responds better to infrared lasers and PDT and RF.

Light and Laser Treatments: An Overview

- ***Low-level visible light alone.*** Strategies use densities that do not significantly elevate temperatures. Light sources range from 400 nm to 700 nm. Blue light sources, KTP lasers and pulsed dye lasers at low settings have shown some success. Even low fluences produce a photochemical effect.
- ***Low-level visible light with ALA.*** Multiple lasers and light sources, when used in combination with topical ALA, have shown some promising preliminary results in the treatment of acne.
- ***Green-yellow light sources and near-infrared light sources.*** These work by



This patient, who had severe cystic acne, underwent five treatments of light microdermabrasion followed by ALA application for 30 to 60 minutes, after which either an IPL or pulsed dye laser (2.6 J/cm^2) was used. Above is the patient before treatment; below is after. Photos courtesy of Dr. Mark Nestor.

heating the vasculature and/or sebaceous glands to decrease the vascularity associated with rosacea.

• ***Mid-infrared lasers***. Three standard wavelengths — 1320 nm, 1450 nm and 1540 nm) have been applied with variable success.

• ***RF devices.*** A monopolar radiofrequency device has shown improvement in both acne and acne scarring. A bipolar device with a broadband flashlamp has shown some temporary improvement in acne in a white paper.

Types of Lights and Lasers

Therapies include laser, short-and broad-band visible light, photodynamic therapy using noncoherent light, and radiofrequency energy (RF).

• ***532 nm green potassium-titanium-phosphate (KTP) laser***. Because this therapy penetrates the dermis between 1 mm and 2 mm, it photoactivates bacterial porphyrins and will reduce *P. acnes* counts.

• ***Flashlamp-pumped pulsed dye lasers (PDLs) combined with coherent yellow light (585 nm or 595 nm).*** These also reduce *P. acnes* counts and potentially, acne lesions. Studies have shown mixed results.

• ***Photodynamic therapy with 5-aminolevulinic acid (ALA) or topical indocyanine green (ICG).*** These therapies target sebaceous glands. Results have been promising.

• ***Long wavelength, mid-infrared lasers: 1450 nm diode laser with cryogen spray cooling that is absorbed by water in the mid-dermis.*** While sebaceous glands are injured through thermal damage, the epidermis is preserved. Several studies have shown this strategy is successful as a primary or adjunctive treatment for acne in patients who want an alternative to medical therapy.

• ***RF lasers.*** One study showed broad improvement using RF; another white paper showed improvement with bipolar RF with the broadband flashlamp.

What the Research Says

The JAMA ***study:*** Researchers from the University of Michigan Medical School, concluded that after 12 weeks, there were no significant differences between low-fluence, pulsed dye laser-treated and untreated skin in mean papule counts, mean pustule counts, or mean comedone counts. Serial photographs offered confirmation.

Experts have said that in the Ann Arbor study, a large number of patients dropped out of the trial, potentially skewing the results. When the study accounted for that dropout rate, however, researchers still found that laser therapy was largely ineffective.

Other studies: One study found that ALA-PDT decreased follicular bacterial count and produced phototoxicity in the sebaceous glands. The therapy reduced the size and sebum output of the sebaceous gland. Significant short-term clearance rates, and long-term improvement of 10 to 20 months were reported. (Hongcharu et al.)

- A study with the Smoothbeam on back acne found a 98% reduction in acne lesions after 4 months. Benefits lasted the length of the study, 6 months after the last treatment. (Ross et al.)
- Another study found that multiple treatments with the same 1450 nm infrared laser reduced facial acne by 83%. (Friedman et al.)
- Research using a 1320 nm infrared laser found that 72% of subjects experienced clearance rates of between 75% and 100%. (Chernoff et al.)
- Another study found that an RF device had a 75% improvement in acne in 92% of patients. (Ruiz-Esparza et al.)

Despite these results, experts agree there are some caveats to using lasers to treat acne. In one study using KTP treatment, for example, patients in laser-only groups experienced more flares, less clearance, and slower response times when compared to groups who used topical agents.

Researchers concluded that laser and light therapy targeting *P. acnes* alone generates a limited response and may provide an effect similar to topical medications.

The Pros and Cons

- ***Pros***

Dermatologists are generally using light and laser therapy for patients who fail topical and oral medications (antibiotics or isotretinoin treatment). Others say the therapies are ideal first-line treatments for patients with active acne and a lot of acne scarring.

Because combination medical therapy raises concerns about antibiotic resistance, lasers and light therapy allow dermatologists to lessen or altogether eliminate drugs from therapy.

> Lasers and light therapy allow dermatologists to lessen or eliminate drugs from therapy.

Laser and light therapy offers an alternative therapy that decreases the side effects of medical therapy.

These treatments can be used in patients intolerant of medical therapy.

Lasers may offer long-term clearing.

Lasers may improve skin texture.

- ***Cons***

Side effects are transient and local, but they can include pain, erythema, edema, crusting, hyperpigmentation and hypopigmentation.

Therapy requires multiple treatments over several months.

The therapies are more expensive than medical treatment — and are frequently not covered by insurers.

Treatments can cause pain or discomfort that patients taking medication don't experience.

Downtime can result from photosensitization that lasts several days.

These therapies are not as convenient as medical therapy, which requires physicians to write a prescription and patients to use in the convenience of their home.

Light and laser therapies require four to six treatments at 4- to 6-week intervals.

Questions Remain

We still have many questions to answer before light and laser therapies potentially become a standard of treatment. For example, we still need to know who to treat, and what duration of clearing or improvement can be repeated. We also need to know what is the best laser for what type of acne.

Also, we need to know what role ALA has in acne treatment after a short application time (30 minutes to an hour). Will permanent sebaceous gland damage occur after such relatively short application times? What's the best wavelength to use with ALA? Can ICG or ALA and red light damage the sebaceous gland with epidermal sparing? What's the role of pulsed light in ALA treatments for acne? Do low-power lights have any role in treating acne other than helping eliminate bacteria? Lastly, we need to know overall how to minimize side effects.

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The Latest Option for "Gentle" Skin Treatments

An inside look at fractional resurfacing.

Richard E. Fitzpatrick,MD, Dieter Manstein, M.D., Suzanne L. Kilmer, M.D.

In the already crowded field of technologies that give dermatologists a "gentle" way of resurfacing skin, one technique is generating a lot of buzz. Fractional resurfacing resembles techniques like short-pulsed erbium and CO_2, but it uses a new mechanism to control damage to the skin being treated.

How It Works

The Fraxel laser treatment works like other laser treatments by producing thermal damage. Unlike other techniques, however, it produces very localized damage patterns.

Fractional resurfacing uses the highest quality laser beam produced by a fiber laser. By delivering a high-energy, highly columnated small spot that produces a distinct column of tissue necrosis, the technique allows for more rapid healing.

The technique produces epidermal and dermal damage in small microscopic thermal zones, with a depth of 200 to 500 microns delivered densely to the skin in a small diameter. Optimal distance between individual fraxels is 200 to 300 microns.

While energy levels typical range between 5 to 20 J/cm^2, lower fluences of 1 to 1.5 J/cm^2 can be used for rejuvenation, and levels of 2 to 3 J/cm^2 can be used for regeneration similar to that achieved with a chemical peel or light er:YAG laser. Higher energy levels in a single pass are similar to CO_2 resurfacing.

One byproduct of fractional resurfacing is epidermal necrotic debris (MEND), a term that describes a microscopic zone of previously necrotic tissue within the epidermis that has shed. Within a few days, the MEND travels through the epidermis. It resembles bronzing or minor erythema, but there is no oozing and no loss of epidermal barrier function.

Indications

Fractional resurfacing has been used in treating photodamage and acne scars. In terms of treating photodamage, the technique has produced significant improvement in texture, color, fine lines, and gradual improvement in deep scars. The technology can be used safely off of the face.

Fractional resurfacing has also been used to treat some conditions for which there are no other significant treatments available. These include melasma, dyspigmentation after laser resurfacing, disseminated superficial actinic keratosis, congenital nevi, and photodamage of the neck, chest, hands, arms and legs.

Side Effects

Patients typically do not experience much pain. Anesthesia can be achieved through a 30% lidocaine gel applied 1 hour before treatment.

Once the procedure has been completed, patients may initially experience some oozing. They may develop a sunburn-like erythema for a day or so, occasional edema, and abrasions.

There is no significant crusting, no dyspigmentation and no post-inflammatory hyperpigmentation (even in Fitzpatrick Skin Type 5). Patients also don't develop hypopigmentation, hyperpigmentation or scarring.

In general, side effects are not as bad as the immediate fallout of ablative resurfacing. Patients are instructed to avoid going outside for a few days after the procedure because the worst effects are typically felt in the first 4 to 5 days. The skin is red when it first peels, but after a week the skin begins to recover nicely.

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Low-Level Lasers and LEDs: Myth or Reality?

Two leading experts argue the pros and cons of the viability of light-emitting diodes generating a cellular response.

LED technology uses special diodes that emit light when connected into an electrical circuit. You typically find the technology in small plastic devices that enclose a semiconductor chip with two electrical leads. They are often so small that you have to use many together. Older LEDs used in electrical devices have a slightly divergent beam and rather low and unstable output powers, as well as a wide waveband of plus/minus 50 nm.

Newer technology, however, incorporates parabolic reflectors, along with collimating and polarizing optics to produce much better light quality. Photodetectors can also help produce a very accurate energy output.What are the cellular targets of photomodulation? They might be mitochondria, which actually absorb visible light in the range of 550 nm to 600 nm and are involved in the energy production of cells. The other possibility is that cell membranes, which might control intercellular communications, could actually be absorbing infrared light. **— Peter Bjerring, M.D., University Hospital of Aanhus, Risskov, Denmark**

POINT: The Case Against LEDs — After 20 years, Still No Solid Evidence

R. Rox Anderson, M.D.

I'm going to stick my neck out and maybe stir the pot a little by saying that LEDs are clinically bogus until proven otherwise.

A lot of people have played with the concept of low-level and visible light and lasers for 20-plus years. To date, there's not a single compelling prospect of a double-blind placebo-controlled trial that is very convincing.

The closest thing is a near-infrared laser trial was conducted by General Motors, and the technology was evaluated as a potential treatment for carpal tunnel syndrome. Aside from this one exception, there's no evidence that clinically this area merits worth.

The flashing yellow LEDs that have come into our realm recently have yet to be put to the test.

The studies that have been done, all by the same authors, have been very limited, and I think unconvincing, in part because the authors are biased. We're lacking independent proof.

Having said that, I must admit that LEDs are scientifically interesting. While I'm 99% sure it's bogus, there's a 1% crack with a little light showing through.

Some of my good friends are the people I'm dinging pretty badly, so I want to put this into perspective. What do we know about LED technology?

Visible light does create many metabolic changes in mammalian cells by both direct photochemistry and secondary signaling pathways. It is absolutely the case that visible light has lots of biochemical effects on mammalian cells.

But cellular response depends very strongly on the specific cell type in the micro environment. When you take cells, culture them and examine various metabolic changes, you find that it's extremely complicated. The same stimulus to one cell that is stimulatory will be inhibitory in other cells.

Moving to the next level, it's impossible to predict tissue response based on cellular response data. You can't take cultured cells and predict how the tissue is going to respond.

And going to the next step, the clinical response is impossible to predict from tissue response data. So, to take some culture cells and do some gene chip assays and predict that one factor will go up and one will go down, and then to treat patients based on these findings and perform an uncontrolled trial is, in my opinion, very uncertain.

I applaud the people who are working in this area. I think they're pioneers. But I recommend that they read a book by Steven J. Gould, "The Mismeasure of Man," which examines how easy it is for scientists to fool themselves.

Dr. Anderson is a Professor of Dermatology at Harvard Medical School. He's also Director of the Wellman Center for Photomedicine at Massachusetts General Hospital.

COUNTERPOINT: LEDs Are Effective — Making the Case for a New Treatment

Roy G. Geronemus, M.D.

I will stake my personal reputation on this because I believe what I've seen with my own eyes. I believe what I hear from other physicians across the country who are using these types of devices on a regular basis and are getting very positive feedback.

The ultimate goal is not what we see in the laboratory as scientists or what we believe should happen as physicians, but what we hear from patients — and what we're hearing from patients is very, very positive. We have patients who are volunteering for these treatments; we have patients who are referring their friends; and I have spoken to colleagues in other parts of the country who are experiencing the same response.

Non-medical LEDs are pervasive in our community. But when we use them in a medical context, we can produce a biological effect on tissue. With the specific parameters based on work by David McDaniel, M.D., in Virginia Beach, we were able to produce a significant effect on tissue. What Dr. McDaniel has done is take fibroblast assays and used different parameters of LED light to produce different effects on tissue.

The concept of photomodulation using low level light is different than what we see with non-ablative techniques because it's non-thermal. LED photomodulation produces absolutely no pain and no injury to the skin. It allows you to treat large areas very quickly, and it uses extraordinarily low energy.

I was part of a multicenter trial that will be published in a couple of months. We looked at wrinkles, roughness of the skin and redness, including pore size. If you look at our results, which are based on a 12-month follow-up after the last treatment session, you can see we have some sustained benefit.

We saw a peak benefit at approximately 4 months after treatment in terms of global improvement. Much to my surprise, we saw improvement of redness, which I have to admit I'm having some difficulty explaining.

We saw an improvement in fine lines on a fairly consistent basis, although not as dramatic as we would see with other techniques. The most dramatic improvement has been in toning, which refers to a global improvement that people see in improved texture and tone of the skin. Patients often report to us that they feel a creaminess of the skin, an incredible softness that they have not felt through any other treatment, whether it's topical or medical.

Treatments last about 45 seconds, and we do two a week, 2 or 3 days apart over 4 weeks. What's unique compared to the other devices we've worked with is a decrease in matrix metalloproteinases (MMPs). And when you decrease collagenase, you have some beneficial effect as well.

If you look at the effect of UVB-UVA as well as the low energy 595 nm light-pulsed dye and a high energy 595 nm pulsed dye, you see an increase in MMPs. Looking at LEDs, however, we actually see a decrease.

So something is happening here, and it proves that you don't need thermal energy to produce a biological effect on tissue.

Another area of significance was the effect we saw of using this LED device to reverse acute UV induced matrix enzyme expression. One question is whether this results in a diminished response to acute UV reaction. As far as I know, there is no technique or treatment out there, other than perhaps nonsteroidal inflammatory agents, that will minimize the effect of sunburn or acute UV injury.

Current uses for LED photomodulation include cosmetic rejuvenation alone or in conjunction with other devices. All of the non-ablative treatments that we perform with devices like the CoolTouch and the Q-Switched YAG laser we now follow with LED treatments.

We also use LED independently to suppress acute UV injury, and we have found it helpful in suppressing UV-induced melasma. Future uses will include hair growth, wound healing and photodynamic therapy.

Roy G. Geronemus, MD, Director, Laser & Skin Surgery Center of New York, Clinical Professor of Dermatology, NYU Medical Center, New York.

When to Choose Intense Pulsed Light (IPL) Over Laser Therapy

A comparison of treatments.

Christopher Zachary, M.D., Neil Sadick, M.D., Christian Raulin, M.D., George Hruza M.D.

More than a decade later, however, IPL has made huge strides in treating common skin problems. And while IPL and IPL RF can treat a variety of conditions, the technology typically requires more treatment sessions than lasers.

Lasers, for example, better target specific chromophores in a single treatment session, while IPL typically requires three to five treatment sessions (depending on whether you use photodynamic therapy as an adjunct). This raises costs and some patients see it as less convenient than fewer treatments.

On the other hand, IPL treatments produce fewer side effects and less downtime for patients. Downtime from lasers can include some degree of crusting or desquamation that can last from several days up to a couple weeks.

So which therapy is best? This question is difficult because no research has directly compared pulsed dye lasers to IPL. That said, here's a head-to-head comparison of how IPL and lasers treat many common conditions.

The Mechanics —and Strengths— Of IPL and Laser

IPL is less target-specific than lasers for several reasons:

- Broad spectrum of wavelengths.
- Relatively low fluence for any individual wavelength.
- Lack of coherence or collimation.

Because of those characteristics, however, IPL has several strengths, which include offering patients a "global" type of treatment. IPL can be effective in patients with photodamage, particularly in combination with:

- vessels
- lentigines
- lackluster skin.

IPL's benefits are less certain when treating photoaging and fine lines. If patients have a lot of rosacea and IPL produces good heat absorption, fine lines can improve.

Lasers remain the better choice when trying to achieve benefits for problems such as individual and spider telangiectasia. Tattoo treatment remains in the realm of the Q-switched laser. IPL for tattoos will just cause a lot of scarring.

A Comparison of IPL and Lasers

The advantages of IPL

- Achieves multiple tasks.
- Covers diffuse anatomic areas.
- Maximal pore reduction.
- Treats generalized pigment dyschromia.
- Treats flushing syndromes like rosacea.
- Treats mild papulopustular acne.
- Produces some skin tightening.
- Effective for telangiectatic matting (neoangiogenesis) on legs.
- Best single technology for non-ablative photorejuvenation.
- Excellent patient satisfaction.

The advantages of lasers

- Chromophore-specific (targets water with secondary effects on sebaceous glands and collagen pigment blood vessels).
- Best single-treatment results for chromophore targets such as wrinkles, papulocystic acne, acne scars, leg veins, hair reduction.
- Fewer treatments/greater efficiency.
- Longer wavelength technologies can be used for darker skin phenotypes and even patients with some degree of tanning.

IPL vs. Laser for Five Common Conditions

1. *Pigmented lesions.* Epidermal pigmented lesions typically require two to

five treatments vs. one to two treatments for Q-switched laser. Lasers usually produce complete fading, while IPL may produce incomplete fading. There is no downtime with IPL, compared to a moderate amount of downtime with lasers.

2. *Vascular lesions.* IPL requires up to five treatments and may produce incomplete fading, has minimal downtime, but it does produce a more global treatment. Pulsed dye laser on average requires two treatments, but creates more downtime for patients because of the use of stacked pulses. Pulsed dye lasers can produces considerable erythema and edema, which can last 2 to 3 days.

3. *Telangiectasias.* Bipolar IPL RF modalities are less reproducible than pulsed dye laser. Some dermatologists like laser therapy better because it gives more reproducible results.

4. *Larger vessels (port wine stains and hemangiomas).* Pulsed dye laser is generally more effective than IPL.

5. *Hair removal.* For dark hair, experts say that both modalities offer similar results, although more treatments are generally needed for IPL. IPL and radiofrequency has been reported to produce an effect on light hairs, an area where lasers aren't successful.

(To compare how IPL RF stacks up to a variety of lasers, view the chart on this page.)

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A LOOK AT IPL COMBINED WITH RF AND HOW THIS TECHNOLOGY COMPARES TO LASERS

(Source: Dr. Hruza)

Pigmented Lesions

IPL RF	Q-switched laser
Two to five treatments	One to two treatments
Incomplete fading	Complete fading
Minimal downtime	Moderate downtime
Global treatment	Spot treatment
Best for >10 lesions	Best for <10 lesions

Vascular Lesions: Redness

IPL RF	Pulsed dye laser
Five treatments	One to two treatments
Incomplete fading	Incomplete fading
Minimal downtime	Moderate downtime
Global treatment	Global treatment
Equivalent results	Equivalent results

Vascular Lesions: Telangiectasias

IPL RF	Pulsed dye laser
Five treatments	One to two treatments
Incomplete fading	Complete fading
Minimal downtime	Moderate downtime
Global treatment	Spot treatment
Less reproducible results	More reproducible results
	More effective for PWS, hemangioma

Photorejuvenation (Red, Brown, Texture, Pores, Fine Lines)

IPL RF	Laser
Five treatments	Need several devices
All parameters improved	to achieve results
Minimal downtime	
More reproducible results	
+/- ALA (fewer treatments, greater downtime)	

Hair Removal

IPL RF	Various lasers
Multiple treatments	Multiple treatments
Incomplete hair removal	Incomplete hair removal
Minimal downtime	Minimal downtime
Global treatment	Global treatment
Equivalent results for dark hair	Equivalent results for dark hair
Some reduction of light hair(with RF)	No effect on light hair

Wrinkles, Acne Scars, Acne

IPL RF alone not very effective	