



Controversies and Conversations in Laser and Cosmetic Surgery

Hear from international experts on how they typically
(and sometimes controversially) tackle skin rejuvenation,
hair removal, acne, vascular lesions and other
common dermatologic conditions.

Supplement to the December 2006

skin
AGING

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Introduction

For the past 17 years, we've offered an annual symposium that covers controversial issues surrounding cutaneous laser and cosmetic surgery. Known as Controversies and Conversations in Laser and Cosmetic Surgery, this conference brings together a faculty of distinguished international physicians, scientists, researchers and other experts who earnestly share their candid views and engage in lively dialogues with others. This year's 3-day symposium again offered a unique opportunity for attendees to discuss controversial topics and current issues in a collegial atmosphere.

Attendees find worth in this advanced symposium because new instruments, technologies, techniques and products emerge every year, and often end up as topics of heated debates. Reliable information about emerging therapies lags months to years behind aggressive marketing, and each new development has proponents and opponents, enthusiasts and skeptics. These meetings have always been stimulating and enjoyable, and the information and opinions that surface are essential to those who have an interest in lasers, light sources, neurotoxins, soft tissue fillers and aesthetic procedures in their practices.

We are proud that Controversies has grown from its original intimate setting to a more diverse gathering of colleagues. Many factors have likely contributed to this development, among them:

- the evolution, growth and acceptance of laser and other energy sources in medicine and their ability to bring about unique benefits
- the growth in breadth and depth of the science and technology in these and related areas
- the marked increase of interest and capabilities in aesthetic medicine.

We hope you find the selections from the presentations that we've chosen for this supplement, as well as the special feature article on ALA-PDT, to be as thought-provoking and interesting as we did.

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Next year's meeting will be held at the Sagamore Resort, Lake George, New York, from August 10 to 12.



The 2006 Controversies meeting took place at the Four Seasons Aviara (pictured above) in Carlsbad, California.

Table of Contents

The State of Nontraditional Acne Treatments

See what your colleagues think about today's lasers, light sources and photodynamic therapy. 1

New Applications of Photodynamic Therapy for Skin Rejuvenation

The use of both 5-aminolevulinic acid and methyl aminolevulinate with photodynamic therapy holds much promise for managing photoaging issues. 4

Home Use of Lasers and Light Sources for Hair Removal, Photorejuvenation, Acne Treatment

How will these technologies change the practice of medicine? Read on to hear the popular opinion. . . 7

Nonsurgical Skin Tightening: Are There Data to Support the Claims?

A look at what companies, doctors and medical spas are saying about this category of devices. 10



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The State of Nontraditional Acne Treatments

See what your colleagues think about today's lasers, light sources and photodynamic therapy.

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Despite somewhat unbridled enthusiasm for device-based efforts, many dermatologists are disappointed in the available nontraditional acne treatment strategies.

This article is a compilation of presentations from the 2006 Controversies and Conversations in Laser and Cosmetic Surgery symposium and has been edited to provide readers with a synopsis of the opinions and thoughts shared on this topic.

Treatment Efficacy

When the FDA approves a new drug application (NDA), it not only assesses for safety, but also for efficacy of the drug. In general, many more human subjects and several hundred million dollars are required to get a new drug approved — even if it's just a combination of two existing, approved drugs. Even so, the efficacy of many new drugs is marginal. On the other hand, to get 510k clearance of a laser or light device, the FDA looks primarily at safety, with less emphasis on efficacy. The bar for efficacy is generally less stringent and fewer patients (often less than 50) are needed to get something approved. This could be one of the reasons why the recently approved devices for acne treatment aren't working quite as well as expected.

Recent studies have shown limited effectiveness for laser and light acne treatments, with the exception of high-dose, red-light ALA photodynamic therapy, which is not an FDA approved indication. Although some treatments work well, most of us still use a lot of oral antibiotics and benzoyl per-

oxide, which are both effective and cost-effective.

The placebo effect in acne treatment can be as high as 40% to 50%, so a 47% effect with an optical treatment method may not be much better than placebo.^{1,2,3} Further work needs to be done to determine the efficacy of devices available for treating acne. This work needs to take the form of placebo-controlled, double-blind studies.

Let's take a look at some of the viewpoints on the technol-

What are the Controversies?

1. Is there a nontraditional acne therapy that really works?
2. How do these nontraditional treatments work to attack acne?
3. Can these treatments destroy or permanently alter the pilosebaceous gland?

ogy presently available for treating acne.

There are several nontraditional light-based acne therapies now available, which include:

- blue (LED or arc lamp) visible light alone,
- various visible light sources used to activate topical ALA-PDT,
- near-infrared lasers and light sources,
- mid-infrared lasers, and
- radiofrequency devices.

This article focuses on the use of ALA with photodynamic therapy (PDT) to treat acne, and discuss the techniques currently in use for this treatment.

Photodynamic Therapy

Some peer-reviewed articles report positive effects of photodynamic therapy (PDT) with ALA in moderate to severe acne. But just how efficacious is this therapy and does it stack up to traditional therapies?

We have to decide whether red light is better than blue light and which incubation time is most effective. One study showed that ALA-PDT can be highly effective, competing with, for example, isotretinoin (Accutane, Amnesteem, Claravis, Sotret), using long application time, high-dose red light and multiple (2 to 4)

Several peer-reviewed articles show the affects of photodynamic therapy with aminolevulinic acid in moderate to severe acne.

treatments.⁴

The 5-ALA (Levulan) preparation, was originally not intended for treating acne or for penetrating to the sebaceous glands. It was designed to treat epidermal pre-cancerous and cancerous lesions. It is FDA approved for the treatment of actinic keratosis.

However, Michael Gold showed 72% clinical improvement of acne using Cleartouch with Levulan.^{5,6} Another study by Macrene Alexiades-Armenakas showed 100% of her patients' acne clearing using Levulan with a pulsed dye laser and then continuing their medical therapy as well.⁷

Treatment for acne could be impacted tremendously if the pharmaceutical companies produced a preparation that delivered ALA to the deep part of the sebaceous gland without significant epidermal protoporphyrin IX production.

Europe has methyl aminolevulinic acid (Metvix), which is a methyl ester of ALA. It's less polar and may prefer the sebaceous gland polar lipid environment more than ALA. Using a red light-emitting diode (LED) panel and some form of ALA that concentrates better into the follicles with roughly a 1-hour incubation time may end up being one way that we're

going to approach this problem in an affordable and hopefully reproducible way.

An important issue to consider is by what mechanisms these treatment strategies go about attacking acne.

Are We Effectively Damaging Sebaceous Glands?

With short-contact ALA, the answer is "probably not." We're probably attacking the infundibulum. The typical incubation time with PDT (15 minutes) is not long enough to allow the ALA to reach the bulk of the sebaceous gland. However, clinical studies suggest good efficacy with short-contact ALA.

Also, no ALA technique has actually destroyed sebaceous glands with the exception of the first two studies published, which established efficacy of ALA-PDT for acne treatment, using long incubation times and high fluences of continuous-wave red light.^{4,8} So at least based on presently available studies using short contact times and/or blue or pulsed light sources, sebaceous gland function is probably not directly affected by these methods.

Martin conducted a study showing that at 3 to 6 hours, sebaceous gland fluorescence roughly correlated with epidermal fluorescence, suggesting that it was difficult to achieve sebu-selective PpIX production with topical ALA.⁹

Continuous-wave red light at high fluences after long (~3 hours) application times of ALA is probably the most effective PDT approach, but epidermal damage occurs with the side effects of pain, desquamation, crusting and hyperpigmentation. In addition, damage of the sebaceous glands under these treatment conditions causes a transient folliculitis, similar to that often occurring with the onset of isotretinoin treatment. An alternative approach suggested by recent studies at Harvard is to use selective photothermolysis to directly damage sebaceous glands. Lipid-selective wavelengths near 1.2 μm or 1.7 μm with a diode laser were identified, which could potentially be used to damage sebaceous glands selectively and might achieve some long-term compromise to the sebaceous gland. This non-PDT approach is still at an early stage of research and development.

As mentioned before, the only study that has clearly shown microscopic and functional evidence of sebaceous gland damage was conducted some years ago by Rox Anderson and colleagues and published in the *Journal of Investigative Dermatology*.⁴ This was the first study reporting use of ALA-PDT for acne, and used long-application time, high fluences of continuous-wave deeply penetrating red light. Another interesting study attempting photo-thermal treatment of sebaceous glands, was reported by Jenifer Lloyd using indocyanine green

New Applications of Photodynamic Therapy for Skin Rejuvenation

The use of both 5-aminolevulinic acid and methyl aminolevulinate with photodynamic therapy holds much promise for managing photoaging issues.

Bruce E. Katz, M.D., and Jessie Cheung, M.D.

Photodynamic therapy (PDT) involves the use of photochemical reactions mediated by the interaction of photosensitizing agents, light and oxygen for the treatment of malignant or benign diseases. The two-stage process starts with the delivery of the photosensitizer to the target cells, and ends with the subsequent activation of the photosensitizer with a specific wavelength of light in the presence of oxygen.

Although various PDT photosensitizers have been studied in

effect. The FDA has not yet approved PDT for the treatment of photoaging, yet dermatologists widely used the technology. The only FDA-approved indication for PDT in dermatology is the treatment of actinic keratoses (AKs), but common off-label uses include treatment of superficial basal cell carcinoma (BCC), photoaging, acne vulgaris, acne rosacea and Bowen's disease.

ALA and photoaging. At present, the optimum parameters for the treatment of photoaging with ALA are unknown. Variations in the number of sessions and in the device, filters, fluence, wavelength and incubation time used could all have a significant impact on efficacy.

Pretreatment considerations for patient selection include the presence of lentigines, telangiectasia, fine rhytids and AKs. Dermatologists must consider the potential for side effects with different skin types.

Post-treatment care includes a soap-and-water wash to remove the ALA or MAL, abundant sunscreen use for 2 days and sun avoidance for 24 to 48 hours. Ice packs and a low-potency topical steroid minimize the expected mild erythema and edema. Topical antioxidants such as vitamins A, C and E should be avoided. Treatments may be repeated every 2 to 3 weeks.

ALA and MAL are contraindicated in patients with porphyria, and caution should be used in patients with cutaneous sensitivity to the wavelengths of light sources used.

In the past, physicians have performed PDT for the treatment of AKs with a 14- to 24-hour incubation period for ALA, followed by irradiation with blue light for 18 minutes.¹ However, a recent study found that a 3-hour incubation period for ALA followed by irradiation with a pulsed dye laser (PDL)

What are the Controversies?

1. Does photodynamic therapy work for skin rejuvenation?
2. What are the optimum parameters for treating photodamage with ALA-PDT?
3. Will MAL-PDT be as effective as ALA-PDT?

dermatology, this article focuses on the use of topically applied 5-aminolevulinic acid (ALA) (Levulan) and methyl aminolevulinate (MAL) (Metvix) for skin rejuvenation. First, let's review the fundamental elements of photoaging.

Photoaging Basics

The treatment of photoaging with traditional therapies has been limited by prolonged downtime and risk of scarring or pigimentary changes, as well as a slow onset of action or minimal

was comparable in efficacy.²

MAL and photoaging. MAL also has the potential to improve photoaging; however, MAL PDT for photoaging has only begun to be used in Europe and efficacy data are not readily available. One study by Freeman et al compared cryosurgery for AKs to MAL with red light, with a third arm control of red light alone. There were a total of two PDT sessions with a 3-hour long incubation of MAL, spaced 7 days apart, versus a single cryosurgery treatment. The resulting response rates to therapy are as follows: 30% for placebo, 68% for cryosurgery and 91% for MAL PDT.³ Cases of allergic contact dermatitis and urticaria to MAL have been reported (the cream contains peanut and almond oils).

The VISIA Complexion Analysis system has a biophotonic scanner that measures the visibility of lentigos, pore size, porphyrins, ultraviolet damage, wrinkles and skin texture. Physicians can use this system to objectively detect improvements in patients whom they treat with PDT.

What the Studies Tell Us

Given the highly variable application times, as well as anecdotal evidence for adjunctive procedures, such as occlusion, microdermabrasion and ultrasound, we conducted a study to compare three ALA application methods and one control.⁴ We applied ALA to four sites on the lower backs of subjects after cleansing them with acetone. Site 1 had ALA incubated for 1 hour alone. We applied ALA to site 2 for 10 minutes alone. For site 3, we made two passes of microdermabrasion prior to



1 Before and after two sessions, 2 weeks apart, of photodynamic therapy with microdermabrasion followed by 10 minute incubation of ALA and then pulsed dye laser, with clearing of actinic keratoses and improvement in photoaging.

a 10-minute incubation of ALA and site 4 underwent microdermabrasion alone. We then performed PDL irradiation at 15 J/cm² and 22.5 J/cm²; these fluences had not previously been shown to produce erythema alone. We used erythema as an endpoint of treatment, and followed subjects at 24 and 48 hours. PDT was most effective in producing erythema with two passes of microdermabrasion prior to ALA incubation for 10 minutes. ALA incubation for 1 hour alone was the next most effective method in producing erythema. We achieved equivalent results at 15 J/cm² and 22.5 J/cm².

A Closer Look at ALA and MAL Use

Aminolevulinic acid (ALA) is currently available in the United States as the Levulan Kerastick, which we apply as a solution. methyl aminolevulinate is available in Europe as Metvix, and is not yet commercially available in the United States. It is slated to be marketed in a cream formulation as Metvixia.

After the application of MAL or ALA to skin, porphyrins accumulate mostly in sebaceous glands and the epidermis. Rapidly proliferating cells accumulate more porphyrins than normal cells, which has prompted the development of ALA and MAL photodynamic therapy (PDT) for the treatment of AKs, Bowen's disease and BCC. Following activation by visible light, porphyrins are excited to a higher energy triplet state. This generation of singlet oxygen species in the vicinity of mitochondria can lead to apoptosis or necrosis of malignant cells. PDT generally has a low potential for causing DNA damage. The wave-

length of light corresponding to a peak in the porphyrin excitation spectrum is used to most efficiently generate a therapeutic effect. The Soret band (405 nm to 420 nm) in the blue spectrum and the red peak at 635 nm are most commonly used. The desired phototoxic reaction on AKs and BCC is characterized by erythema, edema, crusting, vesiculation or erosion. A burning sensation or pruritus is commonly observed during light exposure after ALA or MAL application.

Almost any light source with an output wavelength within the visible spectrum (400 nm to 800 nm) may be used to activate ALA and MAL. Sources currently used include pulsed dye lasers, intense pulsed light, blue light and light-emitting diode. However, efficiency may be compromised if the output wavelength does not approximate the spectral absorption peak of the photosensitizer, which correspond to the blue and red wavelengths.



2

ALA (5-aminolevulinic acid) application study. A: ALA incubated for 1 hour. B: ALA incubated for 10 minutes. C: Microdermabrasion and ALA incubated for 10 minutes. D: Microdermabrasion alone. (The top row was irradiated with the pulsed dye laser at 15 J/cm² and the bottom row at 22J/cm².)

Ruiz-Rodriguez et al conducted a study in which they administered two treatments with ALA followed by IPL. The results showed an 87% response rate with improvement in wrinkling, texture, pigment changes, telangiectasia and AKs. Patients received two treatments with a 4-hour long occlusion of ALA.⁵

A study by Gold et al involved three full-face IPL treatments at 1-month intervals with 15- to 30-minute incubation times with ALA. Qualities assessed included the appearance of crow's feet, tactile skin roughness, mottled hyperpigmentation, erythema and targeted AKs. Ninety percent of the patients had greater than 75% improvement in the Global Improvement Score compared to baseline.⁶

Another study by Gold et al evaluated three split-face treatments with ALA and IPL versus IPL alone at 1-month intervals. Improvements in crow's feet were seen in 55% of those treated with PDT versus 28.5% of those treated with IPL alone. Tactile roughness improved similarly in 55% versus 29.5%. Hyperpigmentation improved in 60.3% versus 37.2%; and erythema in 84.6% versus 53.8%. They noted an improvement in AKs in 78% of those treated with PDT versus 53.6% from IPL alone.⁷

There were no serious events or downtime reported in these studies. The most common side effect was post-treatment erythema or edema for 1 to 2 days.

Dover et al conducted a prospective, randomized, controlled, split-face study with 20 subjects, all of whom completed the study.⁸ A blinded investigator assessed global photodamage, fine lines, mottled pigmentation, tactile roughness and sallowness (on a scale of 0 to 4) before each treatment

and 4 weeks after the final treatment. The subjects received a series of three split-face treatments 3 weeks apart in which half of the face was pretreated with 5-ALA followed by IPL treatment, while the other half was treated with IPL alone. They then received two additional full-face treatments with IPL alone, again 3 weeks apart. Patients completed an assessment at the conclusion of the study comparing their results with pretreatment photographs.

Pretreatment with 5-ALA resulted in more improvement in the global score for photoaging (16 [80%] subjects vs. 12 [60%] subjects; $p=0.008$) and mottled pigmentation (19 [95%] subjects vs. 12 [60%] subjects; $p=0.008$) than IPL treatment alone. Also more successful results were achieved on the side pretreated with 5-ALA compared with the side treated with IPL alone for fine lines (12 [60%] subjects vs. 5 [25%] subjects; $p=0.008$) and mottled pigmentation (17 [85%] subjects vs. 4 [20%] subjects; $p<0.001$). Pretreatment with 5-ALA did not seem to enhance the results of the IPL treatment with respect to improvements over baseline scores for tactile roughness and sallowness.

A Bright Future in Acne Treatment

In addition to treating AKs and superficial BCC, PDT performed with topical ALA and MAL offers new treatment opportunities for photoaging. PDT mimics the effect of light-to-medium chemical peels; however, compared to the more traditional treatments for photoaging, PDT is well tolerated with minimal downtime and has cosmetic as well as therapeutic benefits. No studies to date have reported any scarring. Proper patient selection, preparation and post-treatment care are key to success.

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chromophore under occlusion for 24 hours, followed by exposure to an 810-nm diode laser.⁸

To the best of our knowledge, pulsed light/ALA/PDT with low radiances has never been shown to damage sebaceous glands, so it may be unlikely that this approach will achieve long-term and profound effectiveness for acne.

Use of the Aesthera PPX, which utilizes intense suction plus IPL, and removes sebaceous material from follicles as well as pulls sebaceous glands closer to the light source, has shown some anecdotal promise. However, controlled prospective blinded studies are lacking.

While there is great hope for ALA, as it has a natural selection for sebaceous gland accumulation, this selection bias appears to be only clinically relevant within the confines of incubation times that allow for reasonable uptake. We need a technology that allows for preferential accumulation of ALA in the sebaceous gland without uptake in the adjoining epidermis.

Goals of Therapy

Lasers and light sources may be effective either by inhibiting *P. acnes* bacteria, and reducing inflammation, or somehow affecting the pilosebaceous unit itself. It may be easiest and most efficient to target *P. acnes* through photoexcitation with blue light, but you can use intense pulsed light (IPLs) and lasers. Potassium-titanyl-phosphate (KTP) and pulsed dye lasers have been shown in some studies to improve acne, but not to kill *P. acnes* bacteria.^{7,10-13} Though one randomized, single-blind, controlled, split-face clinical trial concluded that nonpurpuric pulsed dye laser therapy did not result in significant improvement of facial acne,¹⁴ another prospective, single-blind, controlled randomized group study showed good effectiveness. Clearly more research is still needed.

The mechanisms by which lasers, pulsed light sources, and PDT may alter the pilosebaceous unit remain unknown. Acne is the leading cause of facial scarring. Lasers and optical treatments may also help patients by improving fresh or long-standing acne scars.

Room for Improvement

Acne is a disease of multifactorial origin with the end organ being the pilosebaceous gland. To cure acne, we probably need to destroy/permanently alter this gland. Our current laser and light-based therapies, with the possible exception of high-fluence red light treatment after long contact ALA application, do not accomplish this goal. However, used as monotherapy or in combination with other modalities,¹⁵ lasers are showing promise as a

method to rapidly clear acne in a convenient, minimally invasive manner.

Many physicians tend to use lasers or light after they've failed everything else but before using isotretinoin. In combination with topical and systemic medicines, some physicians report 70% to 80% efficacy routinely, but patient compliance with use of the devices is a major problem because of cost and inconvenience to the patient.

Still, there is a clear need for additional long-term data, and randomized, blinded studies comparing one device to another, as well as against conventional treatments. With continued technological advancement in the ability to selectively target *P. acnes* and sebaceous glands, a new frontier in acne treatment may evolve. As the use of oral isotretinoin becomes increasingly controlled and difficult, we need potent alternatives.

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Home Use of Lasers and Light Sources for Hair Removal, Photorejuvenation, Acne Treatment

How will these technologies change the practice of medicine? Read on to hear the popular opinion.

By George Hruza, M.D., Melanie Grossman, M.D., Murad Alam, M.D., Richard P. Felten, David J. Goldberg, M.D., Henry H. L. Chan, M.D., and Daniel Berolet, M.D.

It's clear why home-based technology is going to be important. We started with laser companies making devices for dermatologists and plastic surgeons at more than \$100,000 a device and selling hundreds of them, yet none of the companies really made money. Then the companies expanded to different M.D. specialties including anesthesiologists, emergency room doctors and family doctors, dropped the price on the devices and sold thousands. The companies then targeted spas, and began to sell tens of thousands of devices, and are now looking at maybe a half-a-billion-dollar market. And now the home market seems to be the next frontier.

Some dermatologists argue that home-use devices may enhance patient awareness of the current procedures that dermatologists perform in-house. Others worry that the acceptance and success of home-use devices will change the face of practice. But everyone is concerned about patient safety.

The industry has been successful with hair removal devices (using high energies and deeper penetrating wavelengths, which have been shown to permanently reduce hair growth). Now we're moving to low-energy devices for home use, and these tools have to be ultra safe for obvious reasons. (Unfortunately, with low energies there is a potential for hair stimulation, so we have to be careful because patients could be growing hair rather than getting rid of it.)

Do Proven Medical Indications Exist for Any of These Devices?

Future indications vary because of existing professional systems, and the need for total safety and approved design will

limit efficacy. Low-powered lasers, intense pulsed light (IPL) and light-emitting diodes (LEDs) do work to some extent, and we know that massage suction devices also have some effect.

What Impact Will These Devices Have on Dermatology Practices?

If a doctor directly sells a home-use device, the doctor will have to deal with the financial issues resulting from returns,

What are the Controversies?

1. Are laser and light sources safe for patients to use at home?
2. Do proven medical indications exist for these devices?
3. Can home-use devices have a positive effect on dermatology practices?

pricing competition and loss of revenue once the laser companies sell directly to consumers and to mass-market retailers. Physicians could see a benefit if they position these devices as maintenance therapies for an in-office treatment.

It is possible that when some of these devices are sold off-site, through Web sites or at drug stores, it can inversely help your practice become more profitable. If patients are dissatisfied with the results from this type of a product, you're more likely to attract them to your practice. Then, when they

visit, patients will be introduced to other services that you offer.

Possibilities for the Future

Possible outcomes that could arise from the widespread availability and acceptance of home-use devices are that there will be no change, which is doubtful; that these companies will take our business away; or that these devices may increase

consumer awareness and consequently increase the number of patients we treat.

Most likely, the nature of our practices will undergo a change. We have the opportunity to partner with the products, or we can increase our invasive procedures, which have become less popular.

How can we partner?

We could sell and monitor the devices in our offices, but that does put us at some risk because we would have to protect ourselves against potential liability issues and also question whether or not these devices work and are safe. It seems more interesting to take over the patient's care in instances where a device has failed.

The problem manifests itself when a company starts doing reasonably well selling a product to doctors, but then the companies start selling to Walgreens and then Costco. Some physicians don't believe we should sell these devices in our offices because of this inevitability.

The more of these devices that are out there and that don't work, the more patients will seek our care because they want treatments that work. And the devices that do work will just expand the knowledge base of the market. It's possible that the market can be decreased, but unlikely.

A Look at Available Home Treatments

Zeno. This device has the same efficacy against acne as benzoyl peroxide. It is typically offered for around \$199, so if patients are willing to pay a huge premium for benzoyl peroxide packaged as Actifirm, then this is a bargain. The Zeno is based on heating the isolated cysts up to 40°C. Some dermatologists use the Zeno as an adjunct to everything else they do and patients are interested.

DermaNew microdermabrasion. Offered for roughly \$130, this battery-powered home microdermabrasion tool has no medical benefit; it simply makes skin smoother.

Epila Laser SI-808. Sold in Australia for \$176.19, the Epila Laser is touted by the company as being a "much faster and easier way for hair removal than other existing methods" and having a permanent hair removal and hair reduction effect.

HairMax LaserComb. This device, which claims to improve the appearance of hair and reduce the appearance of thin hair, sells for around \$545 plus shipping. It comes with a 2-year warranty, money-back guarantee and has a 10- to 15-minute treatment time.

LB 500s Laser. The company provides a 1-year warranty with this hair removal laser, which has six adjustable pulse times and 20 different power levels.

Quazar DMD500 Diode Laser. For salon or home use, this hair removal laser retails for \$1,500, but the penny-wise can find it on e-Bay for as little as \$575.

The Beurer SoftLaser VSL40. This "skincare and anti-aging" device is available for as much as \$199. The company promotes it, without objective clinical data, as a safe, non-invasive and highly effective low-level laser that is excellent for wrinkles, acne, age spots, scars, rosacea, eczema, dermatitis, and more.

SoftTouch/Nulase Laser. This battery-operated laser for skin rejuvenation retails for as little as \$276.

No controlled trials regarding the safety and efficacy of these devices have been published. *Caveat emptor.*

Economics

Historically, cosmetic procedures were a boutique service for the select few. A surgeon offered whatever services he or she wanted to and cost didn't matter much. Discretion and exclusivity were the key elements, whereas cost, downtime and technologic innovation were somewhat less important.

These factors will change drastically in the future. We're going to end up with a two-tier system, whereby low-cost, standardized at-home products will be available for the masses — and those who are able to afford more will continue to have access to in-office procedures that are provided by the best physicians.

The factors that will cause the bifurcation in the cosmetic market include technology, consumer desires, market forces and government regulations.

Technology. There's a greater ability to create customized solutions to problems that can be specific for certain skin types, problems, and small batches of products can be made to target specific consumers.

Consumer desires. In general, people don't have as much respect for physicians as they used to. Patients are more interested in the technology that physicians use, and if they can acquire the same device or product from the Internet based on

their specific needs (as determined by filling out a questionnaire), they might very well be willing to do that.

Time and convenience are an issue in the cosmetic dermatology field. Patients have to come in for a consultation to decide what they want, and most procedures require multiple treatments thereafter. Factor in the lost time during that process for travel, waiting, missing work, etc., and it's obvious that these are high barriers that prevent a lot of people from coming in for cosmetic procedures.

However, barriers to entry are falling. Not only is this a problem for dermatologists, but it seems it's an opportunity for cosmetic manufacturers because new electronic technologies comprise a growing size of the cosmetic procedure market.

Market forces. The proliferation of non-physician providers is another major driver in the marketplace. People are getting procedures from physician extenders, and patients are beginning to ask, "If a non-physician can do it, why can't I do it at home with an instruction booklet?"

There's also the issue of corporate power and consolidation. The traditional device and laser companies are no longer going to be the big players because they're too small and not capitalized well enough.

In the future, much larger companies that have the money for research and development will become the power players for these products. Once the marketing arms drive the volume sufficiently to get both high quality at a low price and make something so affordable that the masses are able to easily buy, there will be commoditization, whereby products will become similar (this is already happening).

Commoditization of mature technologies means very little difference in safety and efficacy. Competition is mostly on cost, and that's the area in which home products will win.

Government regulations. There are two kinds of home-use devices: prescription and over-the-counter (OTC), and the FDA reviews and treats each differently. All devices will go through a series of clinical trials to first demonstrate a device is safe and effective, and secondly to demonstrate that individuals can either be trained to use the device safely by healthcare personnel or that they can both self-select and use the device based on the directions for use.

A prescription home-use device will have to show that it can do what it is intended to do. It has to be demonstrated that a person trained by a physician can use a device appropriately and safely. There will be restrictions on how safe it can or can't be made.

Over-the-counter home-use devices will most likely go through two separate studies: a randomized, blinded trial to

show that the device does do what it is intended to do, and another study to show that people can read the directions for use and correctly self-select themselves to be the appropriate people who can use those devices.

Once a few devices are approved for home use, patients will

A segment of patients will continue to prefer to have direct physician delivery of these products and will want the personalized service.

demand more, and once the door is open, more and more devices will continue to come to the market. However, some factors may mitigate this trend and result in a second segment of the market. These factors include the desire for exclusivity, innovation, and liability issues.

A segment of patients will continue to prefer to have direct physician delivery of these products and will want the personalized service. They will be willing to pay a premium for this. Moreover, the services provided in physician offices will always have higher marginal quality because they will be delivered by the more powerful devices.

These home-use devices will have to reach a certain amount of energy to bring clinical efficacy. If they're not efficacious, people won't use them.

As far as the FDA is concerned, clinical trials are needed to prove the efficacy of these devices. We have to encourage patients to use these devices as a complement to therapies administered in our practices to help to maintain the results achieved.

Embracing the Market

Home-use dermatology devices are here to stay.

The likely devices in the near future — and some that are already available on the market — will include hair removal devices, acne devices, skin rejuvenation devices, hair stimulation and cellulite machines. These devices will be sold in department stores, spas, pharmacies, M.D. offices, gyms and directly to consumers.

We need to embrace this home-use market and help the device manufacturers make these devices safe, and we need to help our patients learn how to use them.

Nonsurgical Skin Tightening: Are There Data to Support the Claims?

A look at what companies, doctors and medical spas are saying about this category of devices.

By Elizabeth L. Tanzi, M.D., Christine Dierickx, M.D., Kevin C. Smith, M.D., A. Jay Burns, M.D., and Brian S. Biesman, M.D., Michael Kaminer, M.D., Richard Felten, Suzanne Kilmer, M.D., Roy Geronemus, M.D., Chris Zachary, M.D.

When we age, we are faced with facial, neck and even body laxity and until a few years ago, the only choices for treating these areas were surgery (invasive and noninvasive) and ablative CO₂ resurfacing (for the face). Now there are several nonsurgical, minimally invasive options available. But do they really work, and are the results comparable to surgical correction or ablative techniques?

A big problem in determining successful outcomes is that there is no objective way to measure outcomes in skin tightening. We are also unable to prospectively identify patients

What are the Controversies?

1. Can we objectively measure skin tightening?
2. Are the results from current technologies as good as surgery or ablative techniques?
3. Can we set realistic expectations for patients undergoing nonsurgical skin tightening treatment?

who are going to achieve the most dramatic results. And that leads to overinterpretation of results and inappropriate setting of patient expectations, which is where our problem really lies.

This article will take a closer look at some of the many claims surrounding all of these nonsurgical rejuvenation options, as well as examine the individual technologies and devices.

Skin Tightening and the FDA

There's no device on the market today that has a clearance for a claim of skin tightening because we have no way of measuring effect. Some dermatologists talked about using tattoo dots and measuring changes between dots, but we're not talking about tiny measurements in little spaces, we're really talking about doing almost total face tightening.

The FDA regulates what a manufacturer can say about a product. The manufacturer gets an indication for use and that limits what the manufacturer can say. Physicians, however, are in the practice of medicine, which the FDA does not regulate. The really gray area is some of the information that appears on Web sites. Companies may have a physician offer a testimonial, or refer potential patients to an article that makes claims in favor of their products, or show patients a Web site that includes patient testimonials, for example.

Before we can determine if there are data to support these claims, we need to take a look at what the claims are and what patients may be reading about these noninvasive techniques.

The Claims

The manufacturers' Web sites make claims that, for the most part, have been reviewed and permitted by the FDA, and therefore, often data exist to support these claims.

For example, one site says its device "treats fine wrinkles at the surface while penetrating into the dermis to treat deeper wrinkles." Another one states, "Heating is deployed to tighten and contour both the skin and underlying tissue

with good data supporting this." These are actually relatively reasonable claims in each case.

As for doctors' claims, patients hear, "Thermage is a non-surgical facelift with no downtime." On one Web site, a doctor described Aluma as "a low-risk, virtually pain-free wrinkle removal device that is easily tolerated without anesthesia." This site went on to promise that everyone can achieve a 50% improvement.

What do some of the medical spa Web sites say? "Skin tightening is without peer as a treatment for the loose skin often found in older necks and is very effective for the sagging skin found in upper arms." Another stated, "The world's most effective skin tightening system, tightens skin on the face, neck, jowls, underarms, and abdomen with no anesthesia and no downtime." And finally, "A pain-free alternative to surgical methods, the Titan produces dramatic results."

These physician and patient testimonials and the claims on some of the medical spa Web sites, which aren't mandated by FDA regulations, may make prospective patients come to our offices with inflated expectations, and this is where we run into real trouble.

Let's look at what treatments are available, how they really work and which patients are best suited for these minimally invasive techniques.

The Techniques and Devices

These minimally invasive techniques work by uniformly heating volumes of deep dermal tissue. While they are heating the deep dermis, all of these systems also have some kind of cooling method to protect the epidermis from damage. In the long run, the biological response to this deep heating system is epidermal thickening and an increase in dermal density.

You can use monopolar radiofrequency (RF), which is used in the ThermoCool system from Thermage, or bipolar RF, which is used in the Syneron family of devices, or you can use infrared light sources, such as the Titan device from Cutera or the Lux IR from Palomar or Alma's ST handpiece. Aluma from Lumenis uses a combination of RF and vacuum suction. Another option is fractional laser resurfacing with the Fraxel.

Radiofrequency. The monopolar RF technology used in ThermoCool has been around since 2002. With the original treatment, doctors used a single, non-overlapping pass with high treatment fluences, but many modifications have been made over time. In a study published in *Dermatologic Surgery* on the original technique, 50 patients with either cheek or neck laxity received a single ThermoCool treatment.



2 Patient before (left) and after (right) treatment with Thermage ThermoCool in the areas of the middle and lower face. Photos courtesy of Robert A. Weiss, M.D.

Drs. Tanzi and Alster¹ evaluated the subjects at 3, 6, 9, and 12 months after treatment with digital photographs, clinical grading, and patient satisfaction surveys. Limitations of the original technique include patient discomfort and variability of clinical results. Although no significant side effects were noted in this study, other reports demonstrated complications after a high-energy, single-pass Thermage technique. Dr. Tanzi says she has the best success using the advanced Thermage protocol (low-energy, multi-pass procedure) in a highly select group of patients. The ideal patient is between 40 and 60 years of age with mild-to-moderate skin laxity, is

These minimally invasive techniques work by uniformly heating volumes of deep dermal tissue.

a non-smoker with minimal actinic bronzing and, most importantly, has realistic expectations.

With bipolar RF, in theory, using light and RF together means lower energies of both are required than if either were used alone to reach a desired clinical result. Syneron has developed a device that combines bipolar RF energy delivery with laser light, the Polaris. While some investigators feel strongly that the combination of light and RF energy produce synergistic effect clinically, this has not yet been confirmed in an objective study. Some studies may be underway.

Infrared Light Sources. With Cutera's Titan device, the



Before (left) and after (right) of jawline treated with the Palomar Lux IR.

majority of energy is emitted in the 1100 to 1300 nm range. Once the skin cools sufficiently, the Titan delivers the energy while heat continues to be drawn out throughout the energy delivery, keeping the epidermis safe. Once the energy delivery is complete, the cooling cycle continues for several more seconds to protect the epidermis. The Titan has been shown to treat the lower face and the abdomen with very nice results that are very natural. An important safety issue with Titan, and probably with the other devices that cool the tissue, is when patients hurt too much and they pull away and put their hand over the spot, thereby interfering with the cooling cycle. Instruct patients to raise their hand if the procedure starts to hurt too much, rather than pulling away. That way, you can stop the energy immediately but continue cooling.

If you are focusing on the body (i.e., the arms, legs or the abdomen), consider the Lux IR. The big spot size makes it easy to use this device. It works fast, the pain is very acceptable with pre-cooling before. The large spot size on the Lux IR is too big and the sensor is too complex to use it on the face or around the eyes.

Alma's ST handpiece, which attaches to the company's basic platform, also uses infrared energy. It emits in the 800 to 1000 nm range. A pulse train is delivered over 5 to 15 seconds, depending on the fluence.

Despite the long pulse duration, the large size of the sapphire window still allows the device to be used somewhat

efficiently. Experience with this device is limited and more studies are currently underway.

RF and Vacuum Suction. The Aluma by Lumenis uses a modality referred to by the company as FACES (Functional Aspiration Controlled Electrothermal Stimulation) to induce a conformational change in dermal collagen with subsequent skin tightening. The suction element is adjustable from 4 to 28 mm Hg and draws the skin between parallel electrodes where it is then exposed to electrical current passed between parallel electrodes at power of 2 to 10 W. Treatment times per pulse vary from 1 to 6 seconds. No supplemental anesthesia is required.

Fractional Resurfacing. With fractional resurfacing, multiple microthermal injuries are applied to the skin. The Fraxel II uses a larger spot size spaced further apart and higher energies that give a depth of injury of a millimeter or more. The early impression is favorable. In spite of higher energy, the procedure is less painful and results have been promising.

Comparing These Options to Surgery

While we do see good results with many of these noninvasive options, the results are not remotely as dramatic as those obtained from surgery.

If a patient visits you for skin tightening with one of these noninvasive procedures, you have to set realistic expectations. It's also important to let patients know that not all patients get

great results.

And though the results are not as dramatic, these noninvasive options do offer good alternatives to surgery, especially in meeting the needs of patients who are adverse to surgical intervention and want a more natural look with minimal downtime.

The Challenges

It is clear that noninvasive tissue tightening can produce satisfactory to excellent clinical results with a satisfactory safety profile, but there are still a number of obstacles necessary to overcome.

Patient selection and education are two big challenges because we need to determine the clinical characteristics of

those patients who are either ideal candidates or poor candidates. Other obstacles that remain include the determination of the ideal treatment parameters and algorithms, management of pain during treatment, judgment of clinical endpoints, the dependence of results on treatment technique, justification of treatment costs with clinical outcomes, and the further development of applications on the eyelids and other anatomic regions.

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A Review of Noninvasive, Nonsurgical Approaches to Body Shaping and Cellulite

We don't exactly know what cellulite is, but it is more superficial than fat and is basically clumped adipocytes that are surrounded by a fibrous septa portion. It's an acquired secondary sexual characteristic that is more common in women.

While there is no permanent solution for cellulite, some possibilities exist for body shaping, and some new options are on the horizon. The ideal treatment would be selective photothermolysis of the lobules and removal of some of the herniating superficial fat. Another approach would be to produce some tightening and fibrosis of the deep dermis so that the junction between the dermis and the fat is a little tighter. Another approach would be to somehow change the septi themselves. Following is a review of the current technologies that dermatologists rely on in the battle of the bulge.

Body Shaping Treatment Strategies

Endermologie. This was the first noninvasive treatment FDA-approved to treat cellulite and has been around for a long time, yet there haven't been any improvements in its efficacy.

RF Plus Suction. The VelaSmooth uses bi-polar RF and infrared light along with tissue mobilization and suction to re-contour the skin surface. It is FDA approved, but there are not many studies published in the peer-reviewed literature.

Laser Plus Suction. The TriActive system employs mechanical massage, localized cooling and laser stimulation to improve the appearance of cellulite. It's cleared for the temporary reduction in appearance of cellulite, and with the device's deep heating and rhythmic massage patients may experience some lymphatic drainage. In addition, it's supposedly comfortable and doesn't cause a great deal of bruising. The device is also a Class I device, so that a wider variety of practitioners can operate it.

Monopolar RF. ThermaCool by Thermage uses monopolar RF and cooling. An early known side effect was dimpling associated with fat necrosis. Anecdotal reports show improvement in cellulite and show that ThermaCool can target fat as well as fibrous septae. A multicenter trial to investigate shaping of arms and possible improvement in cellulite is underway.

Focused Ultrasound. The UltraShape and Liposonics are effective, noninvasive treatments that more selectively target fat. Ultrasound affords more of a mechanical effect; you disrupt the fat cells, and with a single treatment, you can get improvement with no injury to the surrounding area. UltraShape, which is a noninvasive, non-thermal, focused ultrasound device, is not yet FDA cleared, but it has a CE mark in Europe. Some consider it an effective solution for noninvasive body contouring. A single treatment will yield measurable results most of the time, and two to three treatments may yield the optimal result.

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