

Continuing Medical Education Article— Facial Aesthetic Surgery

Nonablative Laser Resurfacing: State of the Art 2002

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Learning Objectives:

The reader is presumed to have a basic understanding of the use of lasers in plastic surgery and laser physics. After reading this article, the participant should be able to:

1. Summarize the skin changes resulting from age and sun damage.
2. Explain the mechanisms of action for nonablative resurfacing.
3. Compare the different types of lasers used for nonablative resurfacing.

Physicians may earn 1 hour of Category 1 CME credit by successfully completing the examination on the basis of material covered in this article. The examination begins on page 435.

Background: Nonablative resurfacing, also referred to as subsurface or dermal remodeling, is a recently introduced technology for restoring damaged collagen without injuring or removing the overlying epidermis. To date there have been no published comparisons or reviews of these laser systems.

Objective: The authors review the mechanisms of action of currently available nonablative laser technologies and published data on their performance.

Methods: Literature concerning nonablative laser technology published between 2000 and 2002 was reviewed by use of Medline searches. Data on technical specifications were obtained from the manufacturers.

Results: Significant improvement in skin elasticity and photodamage with few or no complications was noted after treatment with most of the systems reviewed. However, the results were generally more subtle than those achieved with ablative lasers.

Conclusions: Nonablative technology is currently at the forefront of skin rejuvenation. Data on long-term results must await several more years of accumulated clinical treatment. Improvement in skin quality, tone, and texture can be expected, but patients and physicians who expect nonablative laser treatment results to be similar to those achieved by ablative techniques may be disappointed. (Aesthetic Surg J 2002;22:427-434.)

Physicians who perform skin rejuvenation procedures are currently being inundated with new devices designed to provide wrinkle reduction and restoration of skin elasticity without the recovery time or risks associated with the use of ablative lasers or peels. Many of these devices are truly novel; whereas others are new applica-

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The authors have no financial interest in the devices discussed in this article, and have received no funding from the manufacturers.

Accepted for publication May 24, 2002.

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1090-820X/2002/\$35.00 + 0

70/1,128619

doi:10.1067/maj.2002.128619

tions of older technologies. The claims made by device manufacturers, some practitioners, and the media have made it extremely difficult for the clinician to adequately judge the efficacy of these devices or evaluate the purported differences between them. Moreover, observed clinical results, although relatively satisfying to the patient who wants to avoid more extensive treatment requiring longer recovery, are often not clinically significant to the treating physician.

The purpose of this brief review is to look at published data and mechanisms of action of the currently available technologies for nonablative resurfacing. We reviewed literature published between 2000 and 2002, as located through Medline searches. We also asked the laser manufacturers mentioned in the literature to provide technical specifications for their devices.

Causes of Skin Damage

The effects of aging on the skin include a loss of normal elastic fibers and function, as well as changes in collagen and collagenase activity.¹ However, solar exposure and resultant photodamage appear to be more significant than chronological aging in producing the typical changes associated with "aged" skin.² Long-term ultraviolet exposure produces histologic evidence of solar elastosis: an accumulation of abnormally oriented elastic material in the superficial to mid dermis that replaces the normally arranged collagen and elastic fibers.²⁻⁴ Additionally, long-term sun exposure causes both a decrease in collagen and a disruption of normal structure and fiber organization.² The clinical effects of these changes are sagging, wrinkling, furrows, and pigmentary and texture changes.

Treatment Options

Topical agents

Myriad methods can be used to treat photodamaged skin. These include topical agents such as retinoic acid, various peels, dermabrasion, and laser resurfacing. These treatments correct chronic photodamage through somewhat similar mechanisms. All lead to thermal, mechanical, or chemical trauma to the dermis.⁵ The biologic response to this trauma leads to deposition of a new extracellular matrix. In addition, the healing process results in more normally oriented collagen and elastic fibers and a thickened Grenz zone separating the dermis and epidermis. Topical agents like retinoic acid are somewhat effective,

but they are not able to elicit a response strong enough to correct deep furrows and wrinkles.⁶ In contrast, deeper peels, dermabrasion, and ablative lasers are able to correct photodamage through removal of damaged tissue by inducing a biologic inflammatory response.

Ablative laser resurfacing

Laser resurfacing produces ablation of tissue and may add a thermal component to the nonablated tissue. Laser fluence, density of laser overlap, differences in laser type (carbon dioxide vs erbium), and pulse durations determine both the amount of dermal heat deposition, as well as the depth of denatured tissue.⁷ Experimental evidence has shown that increasing the temperature of collagen to 60° to 70° C causes changes that result in remodeling.⁸ Recent laser studies indicate a correlation between the laser's thermal effect and greater rhytid reduction.⁹

Unfortunately, there also appears to be a correlation between greater thermal damage and a greater risk of complications, especially scarring.¹⁰ Treatment with any ablative laser system involves a delayed healing phase that characteristically lasts 5 to 10 days. This healing phase is then followed by erythema that may last for months.

Nonablative laser resurfacing

The key to treatment with the newer generation of ablative lasers is the modulation of heat deposition to the lowest level, leading to a clinically relevant change in collagen remodeling (ie, wrinkle reduction). The goal of nonablative resurfacing, also referred to as *subsurface* or *dermal remodeling*, is to restore damaged collagen without injuring or removing the overlying epidermis. The mechanism of action inherent in all such devices is the use of light energy to selectively damage the dermis (and aged collagen), triggering an inflammatory response and the resultant collagen repair. The restoration of collagen and elastic fiber, produced by either an ablative or nonablative device, results in decreased wrinkles.¹¹⁻¹³ However, the epidermis remains unharmed when nonablative techniques are used, in contrast to ablative laser treatments.

Many lasers and light sources at different wavelengths are currently being promoted for nonablative resurfacing. They differ in their depth of penetration and their selective or nonselective approach toward dermal injury.

Selective photothermolysis is the concept that provides for

a specific wavelength laser to be maximally absorbed by the desired target tissue and minimally absorbed by the adjacent nontarget tissue.¹⁴ The target substances are known as *chromophores*. Each chromophore has a different absorption spectrum, on the basis of its inherent chemical structure. Applying the concept of photothermolysis to nonablative resurfacing, the laser targets an absorption peak specific to the targeted dermal structure—water, hemoglobin, or some other yet to be defined chromophore. This somewhat nonselective approach enables dermal collagen denaturation, inflammation, and repair.

The degree of heat transmission after nonablative resurfacing depends on the laser wavelength, emitted fluence, and the depth of the absorbing chromophore within the dermis. Excessive heat production could in theory lead to thermal damage to the epidermis. This would defeat the benefit of nonablative resurfacing, prolong recovery time, and potentially lead to a greater risk of scarring. Some nonablative systems use epidermal cooling systems to reduce the risk of injury. Currently used systems may include cryogen spray devices that deliver a burst of cryogen spray before, during, or after laser pulse delivery; contact cooling systems that deliver continuous cooling before, during, or after laser pulse delivery; or continuous air cooling systems.

Current Nonablative Laser Systems

Pulsed dye (585 to 600 nm)

The flashlamp-pumped pulsed dye laser was the first laser to be developed on the basis of the principle of selective photothermolysis. It was specifically designed to treat port wine stains. Although initially used with a 577-nm wavelength (a hemoglobin absorption peak) and a 450- μ s pulse duration (shorter than the thermal relaxation time of targeted cutaneous vascular lesions), currently available pulsed dye lasers emit wavelengths between 585 and 600 nm, with pulse durations between 350 μ s and 40 ms. Longer wavelengths and longer pulse durations lead to the targeting of a variety of different vessel sizes.

During the past decade, physicians who have used these lasers for treatment of vascular lesions have noticed anecdotal improvement in skin elasticity and texture. Some physicians also reported improvement of skin striae.¹⁵ Treatment of hypertrophic scars and keloids with pulsed dye lasers has been shown to produce both clinical improvement and histopathologic improvement of dermal collagen.¹⁶ The absorbing chromophore would

appear to be dermal vascular vasculature containing hemoglobin. Potential laser-induced increases in regional mast cells, which secrete cytokines that modulate the inflammatory response, may account for the noted skin improvement.

Pulsed dye laser-induced nonablative remodeling of photodamaged skin has been shown to increase collagen, elastin, and collagenase production. A clinical study by Zelickson et al¹⁷ showed improvement in 90% of mild to moderate wrinkles and 40% of moderate to severe wrinkles after one treatment with a 585-nm 450- μ s laser. Posttreatment biopsy specimens revealed deposition of well-organized collagen and elastic fibers.

Traditional pulsed dye laser treatment is often complicated by purpura, which limits the usefulness of this device for nonablative resurfacing. A recent study has shown increased collagen production without purpura using a lower fluence, shorter pulse duration, pulse dye laser treatment.¹⁸ However, further studies are required to evaluate the clinical usefulness of pulse dye laser nonablative treatment. Current pulsed dye lasers that may play a role in nonablative resurfacing include the V-star series from Cynosure, Inc (Chelmsford, MA: air cooling and emitted wavelengths varying between 585 and 600 nm), V-beam, from Candela Corp. (Wayland, MA: cryogen cooling, 595-nm, and emitted pulse durations of 1.5 to 40 μ s) and the Nlite from ICN/ Medical Alliance (Costa Mesa, CA: 585-nm, 350- μ s 3-joule system) (Table 1).

Nd:YAG (1064 nm)

The Q-switched Nd:YAG laser, with its 1064-nm wavelength, was introduced in the late 1980s for tattoo and pigmented lesion removal. Its absorption in the skin can lead to a specific nonselective photomechanical effect in the dermis.

The Q-switched Nd:YAG laser was the first laser evaluated for nonablative resurfacing. Goldberg et al¹⁹ treated patients with perioral and periocular rhytids with a Q-switched Nd:YAG laser at 5.5 J/cm² and a 3-mm spot size with overlapping passes and a clinical end point of pinpoint bleeding. No surface cooling was used. After 3 months, there was clinical improvement in 9 of 11 patients, but only 3 had improvement comparable to ablative resurfacing.

In an expanded follow-up study, Goldberg et al²⁰ used a Q-switched Nd:YAG laser with a topical carbon-assisted

Table 1. Pulsed dye lasers used for nonablative resurfacing

Laser	Wavelength (nm)	Energy output (J/cm ²)	Pulse width	Cooling system
Candela V-Beam	595	25	1.5-40 μ s	Cryogen
Cynosure Photogenica V-Star	595	25	0.5-40 ms	Air
ICN Medical Alliance NLite	585	3	350 μ s	None

Table 2. Q-Switched Nd:YAG lasers used for nonablative resurfacing

Laser	Wavelength (nm)	Energy output (J/cm ²)	Pulse width	Cooling system
Altus				
Continuum C ³	1064/532	5-12	5-7 nsec	None
Continuum Medlite IV	1064/532	5-12	5-7 nsec	None
Lumenis Versapulse	1064/532	4	5 nsec	None
Palomar Q YAG 5	1064/532	2-12.6	3 nsec	None

Table 3. Long-pulse Nd:YAG lasers used for nonablative resurfacing

Laser	Wavelength (nm)	Energy output (J/cm ²)	Pulse width	Cooling system
Altus				
Coolglide	1064	10-100	10-100 μ s	Contact
Coolglide Excel	1064	10-300	1-300 μ s	Contact
Cooltouch Varia	1064	to 500	0.3-500 ms	Cryogen/contact
Cosmos Medical Athos	1064	15-120	3-5 μ s	None
Laserscope				
Lyra	1064	100	20-100 μ s	Contact
Lyra XP	1064	200	20-100 μ s	Contact
Lumenis Vasculight	1064	70-150	2-16 ms	Contact
Sciton Image	1064	10-400	5-200 ms	Contact or air

solution as an added chromophore. He used lower fluences (2.5 J/cm²) than those used in the previous study. Subjects were treated 3 times at 4-week intervals. No epidermal disruption was noted. At 8 months, more than 85% of patients had some degree of improvement.

Further studies were performed with a non-Q-switched millisecond Nd:YAG laser at fluences of 100 to 130 J/cm² and pulse durations of 3 to 8 μ s for 5 treatments over an 8-week period. Side effects were minimal. Most patients showed some clinical improvement.²¹ Current Q-switched Nd:YAG lasers include those marketed by Lumenis Inc. (Santa Clara, CA:Versapulse), Altus Medical, Inc. (Burlingame, CA), and Palomar Medical Technologies, Inc (Burlington, MA) (Table 2).

Newer longer-pulsed millisecond 1064-nm Nd:YAG laser systems are currently marketed for hair removal and treatment of vascular lesions. These may play some role in nonablative treatments. One of the authors (J.N.P.) has observed some improvement in nonfacial skin tightening in patients treated with a long-pulse Nd:YAG laser. Long-pulse 1064 lasers include those marketed by Altus Medical, Cooltouch (ICN, Costa Mesa, CA), Cosmos Medical Technology, Inc (San Diego, CA), Laserscope (San Jose, CA), Lumenis, and Sciton USA, (Palo Alto, CA) (Table 3).

Nd:YAG (1320 nm)

The 1320-nm Nd:YAG laser was the first laser to be marketed specifically to physicians for nonablative

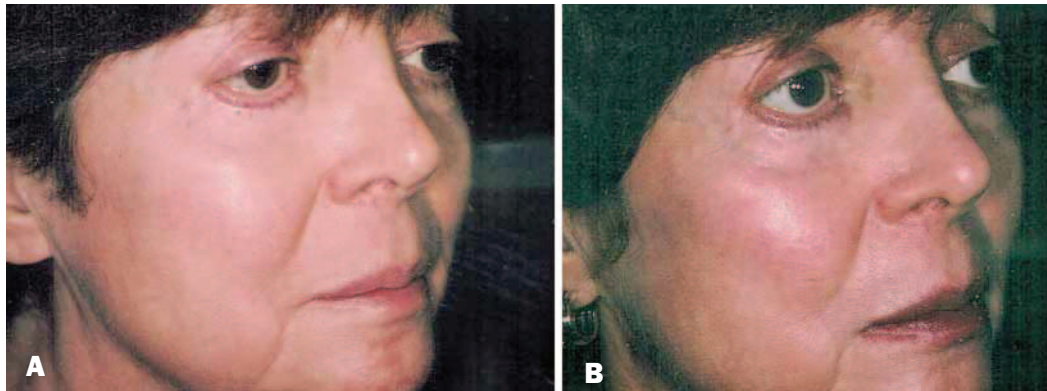


Figure 1. **A,** Preoperative view of a 45-year-old patient before treatment. **B,** Postoperative view 6 months after treatment with a 1320-nm Nd:YAG laser shows improvement in skin quality.

Table 4. Near-infrared lasers used for nonablative resurfacing

Laser	Wavelength (nm)	Energy output (J/cm ²)	Pulse width	Cooling system
Cooltouch II	1320	20	60 ms	Cryogen
Candela Smoothbeam	1450	25	250 ms	Cryogen
Qunatel Aramis	1550	80	3 ms	Contact

resurfacing. The intended chromophore for this laser is dermal water. Because of its greater water absorption and nonspecific dermal scatter, absorption is more superficial than that of the 1064-nm lasers. The thermal wound created by this laser necessitates cooling of the epidermis to prevent blistering. The first-generation 1320-nm Nd:YAG laser, the Cooltouch I (CoolTouch), offered cryogen cooling only before laser exposure (Table 4). This laser was accompanied by a unique handpiece with 3 portals; one portal contained the cryogen spray that cooled the epidermis, one portal emitted the 1320-nm Nd:YAG laser irradiation; and the third contained a thermal sensor. The second-generation 1320-nm Nd:YAG laser, Cooltouch II, offers a larger spot size (10 mm vs 5 mm) and the ability to cool the skin before, during, and after the laser exposure (Table 4). This leads to even better control over the depth of thermal wound induction.

Nelson et al²² were among the first to show small but statistically significant improvement in rhytids with the original Cooltouch I with 3 treatments at 2-week intervals. Cooling the epidermis was mandatory. Studies of this laser without appropriate cooling have shown an increased chance of scarring. D. J. Goldberg²³ was the

first to show histologic evidence of new collagen formation after 1320-nm Nd:YAG laser irradiation. Because this laser produces new collagen formation, it has also been suggested as an adjunct of a full-face antiaging approach (Figures 1 and 2).²⁴⁻²⁶

Diode 1450

The 1450-nm diode laser has recently been introduced by Candela for dermal collagen remodeling (Table 4). This laser also relies on dermal water as a nonspecific chromophore. Injury is directed at the upper dermis, producing a mild thermal injury that promotes remodeling and deposition of new organized collagen. A cryogen spray is delivered to the skin surface before, during, and after laser exposure to limit epidermal damage. A recent study documented the efficacy of this laser system (Figures 3 and 4).²⁷

Erbium:Glass

Erbium:Glass lasers at 1540 nm, like the 1450-nm diode laser, target a superficial dermal water chromophore. Fournier et al²⁸ evaluated the effect of a 1540-nm Er:Glass laser in 60 patients treated 4 times at 6-week intervals. Clinical improvement was noted by photography and through profilometry and ultrasound methods.

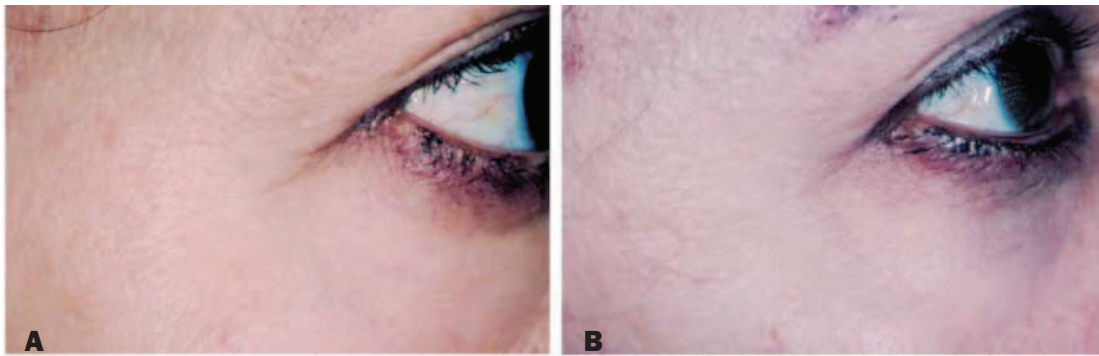


Figure 2. A, Preoperative view of a 42-year-old patient. B, Postoperative view 6 months after treatment with a 1450-nm diode laser shows improvement in rhytids.

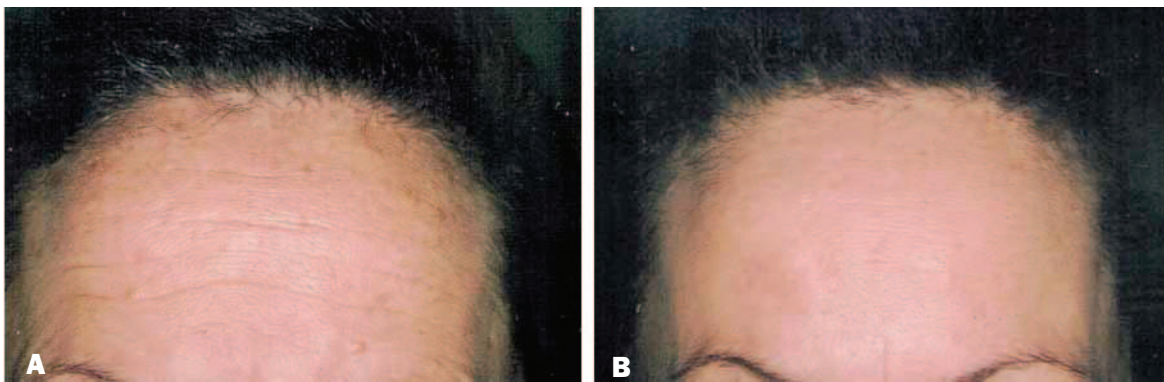


Figure 3. A, Preoperative view of rhytids in a 47-year-old patient. B, Postoperative view 6 months after treatment with the IPL source. Such significant improvement is the exception after nonablative treatment.

Intense Pulsed Light

Intense pulsed light (IPL) devices are nonlaser flashlamp devices that deliver a high-energy pulse of multiwavelength light energy. The emitted wavelengths are controlled by the use of cutoff filters that limit the wavelength to a specific range between 500 and 1200 nm. Because of their varying emitted wavelengths, these devices have the potential to be more versatile than most lasers for a variety of indications, including nonablative rejuvenation. When the chosen filter allows emission of wavelengths in the 550- to 800-nm range, the superficial chromophores of epidermal melanin and dermal oxyhemoglobin absorb IPL energy. This results in significant improvement in epidermal pigment changes and clearing of small superficial vessels. A different cutoff filter may lead to emission of longer wavelengths and nonspecific absorption of dermal water. The result is widespread dermal heating that causes collagen inflammation and subsequent remodeling.

This technique is currently described as photorejuvenation I if only the pigmented and vascular changes are

sought, and photorejuvenation II if deeper dermal changes are desired. Thus patients with rosacea, solar lentigines, and mild photodamage with fine lines are believed to be good candidates for this procedure.

Although, in theory, these devices appear to be more versatile than most lasers, differences in skin reaction and a fairly steep learning curve have made the results somewhat variable. Newer IPL devices, such as the Quantum SR (Lumenis) have sought to provide more user-friendly treatment approaches (Table 5).

In the first study evaluating the dermal effects of IPL, Goldberg et al²⁹ treated 30 women aged 35 to 65 years, Fitzpatrick type I-II with class I-II skin phenotypes.²⁹ Treatment areas included the periorbital, perioral, and forehead regions. One to 4 treatments were given over 10 weeks. Noncoherent intense pulsed light was delivered to the skin with a 645-nm cutoff filter. This led to emission of light with wavelengths between 645 and 1100 nm. Light was delivered through a bracketed cooling device, in triple 7- μ s pulses, with a 50- μ s interpulse delay between the puls-

Table 5. Intense pulsed light devices used for nonablative resurfacing

Device	Wavelength (nm)	Energy output (J/cm ²)	Pulse width	Cooling system
Alderm Prolite	550-900	10-50	20-120 ms	None
Palomar EsteLUX	500-1200	4-12	10-100 ms	Contact
Lumenis				
VascuLight SR	515-1200	3-90	0.5-25 ms	Contact
VascuLight HR	515-1200	3-90	0.5-25 ms	Contact
VascuLight VS	515-1200	20-65	2.5-6 ms	Contact
VascuLight VX	515-1200	20-60	0.5-25 ms	Contact
IPL Quantum SR	560-1200	25-45	2-7 ms	Contact

es. Delivered fluences were between 40 and 50 J/cm². The authors evaluated the degree of improvement 6 months after the last treatment. Complications were also evaluated at this time. Clinical improvement was divided into 4 quartiles: (1) no improvement; (2) some improvement; (3) substantial improvement, and (4) total improvement.

Six months after the final treatment, 5 patients demonstrated no improvement, whereas no patients had total improvement. Sixteen patients showed some improvement and 9 showed substantial improvement (Figures 5 and 6).

All subjects were evaluated for pigmentary changes, post-treatment blistering, erythema, and scarring. Three of the 30 patients were noted to have blistering immediately after treatment. All 30 patients had posttreatment erythema. Six months after treatment, no pigmentary changes, erythema or scarring was noted. New collagen formation was also noted, but the changes appeared to be subtler than those seen with ablative techniques.³⁰

In a recent study by Bitter,³¹ 49 patients with varying degrees of photodamage and wrinkles were treated with 4 to 6 full-face treatments at 30 to 50 J/cm² at 3-week intervals.³¹ Sixty-four percent of patients had 25% or greater improvement, 46% had 50% or greater improvement, and 18% had 75% improvement in fine wrinkles. Eighty-eight percent of patients expressed satisfaction with the treatment results, and 96% said they would recommend the procedure. Adverse effects were minimal.

In the only study comparing IPL with another laser (millisecond 1064-nm Nd:YAG), Goldberg et al²¹ noticed similar results with both techniques for fine wrinkles. However, fewer complications and adverse reactions were noted with the 1064-nm Nd:YAG laser.²¹

Dermaphoresis/Sonophoresis/Phonophoresis/Radiofrequency

New nonablative techniques called *dermaphoresis/sonophoresis* were recently introduced in which ultrasonic waves or light energy is used to enhance the transdermal or transcutaneous delivery of topical chemicals or drugs. Additional systems that use low-level electrical energy to stimulate collagen are also becoming available. Although the technology is intriguing, long-term studies to evaluate these new techniques are needed.

Nonlaser, nonlight source electrosurgical devices (Thermage, Inc, Hayward, CA) are now being investigated for their role in nonablative dermal remodeling. Such devices use a radio-frequency generator and cryogen cooling to heat the skin and subcutaneous tissue. This technology has the potential for deeper penetration than is attainable with lasers and light sources and may provide for a tissue tightening effect rarely seen with other nonablative technologies. Early results appear promising, but further studies will be required to determine the exact roles for this method of treatment.

Conclusion

Nonablative technology is currently at the forefront of skin rejuvenation. Unfortunately, much information about these systems has bypassed the traditional study phase. Manufacturer marketing and media blitzes have progressed at a significantly faster pace than clinical research studies. The techniques are all fairly new. Long-term data must await several more years of accumulated clinical treatment. Patients and physicians expecting nonablative results to be similar to those seen after ablative techniques may be disappointed. In contrast, realistic expectations of improvement in skin quality, tone, and

texture can be fulfilled in what is becoming the fastest growing area of cutaneous cosmetic laser surgery. ■

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Continuing Medical Education Examination—Facial Aesthetic Surgery: Nonablative Laser Resurfacing: State of the Art 2002

Instructions for Category 1 CME Credit

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Multiple Choice

1. Chronological aging produces:
 - A. Loss of normal elastic fibers and function
 - B. Changes in collagen
 - C. Changes in collagenase activity
 - D. All of the above
2. Long-term solar exposure causes all of the following *except*:
 - A. Solar elastosis
 - B. Decrease in collagen
 - C. Increase in normal collagen
 - D. Disruption of normal structure and fiber organization
3. The clinical effects of altered collagen and elastic fibers are:
 - A. Sagging
 - B. Wrinkling and furrows
 - C. Pigmentary and texture changes
 - D. All of the above
4. Chemical peels, dermabrasion, and laser resurfacing all may lead to:
 - A. Deposition of a new extracellular matrix
 - B. More abnormally oriented collagen and elastic fibers
 - C. A thinner Grenz zone
 - D. Furrows and wrinkles
5. The amount of dermal heat deposition by a laser is determined by:
 - A. Fluence
 - B. Density of laser overlap
 - C. Differences in laser type (carbon dioxide vs erbium)
 - D. Pulse durations
 - E. All of the above
6. Nonablative lasers target all of the following except:
 - A. Water
 - B. Melanin
 - C. Hemoglobin
 - D. Some other yet to be defined substance
7. Cooling systems for nonablative resurfacing include:
 - A. Cryogen spray
 - B. Contact cooling
 - C. Continuous air cooling systems
 - D. All of the above

8. Flashlamp-pumped pulsed dye lasers target:

- A. Melanin
- B. Hemoglobin
- C. Dermal water
- D. Other

9. The 1320-nm and 1450 Nd:YAG lasers target:

- A. Melanin
- B. Hemoglobin
- C. Dermal water
- D. Other

10. Photorejuvenation refers to treatments performed with:

- A. Nd:YAG laser
- B. Intense pulsed light
- C. Flashlamp-pumped pulsed dye laser
- D. Tanning beds

True or False

11. Increasing the temperature of collagen to 50° to 60° C causes changes that result in remodeling.

T F

12. Solar elastosis is an accumulation of abnormally oriented elastic material in the deep dermis.

T F

13. The goal of nonablative resurfacing is to restore damaged collagen without injuring or removing the overlying epidermis.

T F

14. The mechanism of action of nonablative lasers is to

selectively damage the dermis (and aged collagen) with light energy, causing an inflammatory response and resultant collagen repair.

T F

15. Selective photothermolysis is the concept that provides for a specific wavelength laser to be maximally absorbed by desired target tissue and minimally absorbed by the adjacent nontarget tissue.

T F

16. Because of greater water absorption and its nonspecific dermal scatter, the 1320nm Nd:YAG laser's absorption is deeper as compared with the 1064nm lasers.

T F

17. Intense pulsed light (IPL) devices are nonlaser flashlamp devices that deliver a high-energy pulse of multiwavelength light energy.

T F

18. Intense pulsed light (IPL) devices control wavelengths by the use of cutoff filters that limit the wavelength to a specific range between 500 and 1200 nm.

T F

19. Nonablative resurfacing produces results similar to those seen after ablative resurfacing.

T F

20. Patients undergoing nonablative resurfacing must be advised about realistic expectations of improvement in skin quality, tone and texture.

T F

Evaluation

1. Overall, did the activity provide an adequate overview of the subject matter?

___Yes ___No

2. Was the subject matter of the activity:

___ Too basic ___ Too advanced ___ Just right

3. Do you feel that the length of the activity was:

___ Too short ___ Too long ___ Just right

4. This activity increased my awareness and understanding of the procedures described in the article.

☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

5. I would again participate in an *Aesthetic Surgery Journal* CME activity.

☐ Yes ☐ No

6. Would you recommend an *Aesthetic Surgery Journal* CME activity to a colleague?

☐ Yes ☐ No

7. What other topics (including instructor names, if possible) would you like covered in future issues of *Aesthetic Surgery Journal*?

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