Current Laser Resurfacing Technologies: A Review that Delves Beneath the Surface

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Semin Plast Surg 2012;26:109–116.

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Abstract

Numerous laser platforms exist that rejuvenate the skin by resurfacing its upper layers. In varying degrees, these lasers improve the appearance of lentigines and rhytides, eliminate photoaging, soften scarring due to acne and other causes, and treat dyspigmentation. Five major classes of dermatologic lasers are currently in common use: ablative and nonablative lasers in both fractionated and unfractionated forms as well as radiofrequency technologies. The gentler nonablative lasers allow for quicker healing, whereas harsher ablative lasers tend to be more effective. Fractionating either laser distributes the effect, increasing the number of treatments but minimizing downtime and complications. In this review article, the authors seek to inform surgeons about the current laser platforms available, clarify the differences between them, and thereby facilitate the identification of the most appropriate laser for their practice.

Keywords

- laser
- skin
- resurfacing
- photorejuvenation
- ablation
- fractional

Laser resurfacing technologies represent an exciting development in the cosmetic surgeon's repertoire to improve the tone, texture, and pigmentation of the skin. Although laser resurfacing is not a substitute for a facelift or blepharoplasty, the appropriate laser not only tightens the skin somewhat but also improves the appearance of lentigines, rhytides, skin texture, and a wide variety of scars.

There are ablative and nonablative lasers as well as fractionated and nonfractionated lasers. Nonfractionated lasers act on the entire projected surface area of the treated skin, whereas fractionated lasers target an equally distributed portion of the projected area. An easy way to understand the difference is in looking at the pixels that compose a TV image. Nonfractionated devices treat every single pixel whereas fractionated devices treat only a percentage of the pixels in the treatment area.

Ablative lasers vaporize tissue and therefore are more aggressive compared with the gentler nonablative lasers that leave the skin intact. Although ablative lasers result in far more down time and a more difficult recovery process, they remain the lasers that produce the most dramatic outcomes. For more severe facial wrinkles, dyspigmentation, and textural skin challenges, the ablative laser is often the treatment of choice.

For patients seeking more moderate improvement—without the possible side effects of ablative lasers—nonablative lasers are often ideal. These lasers leave the epidermis intact while producing rejuvenating skin effects. Depending on the technology, nonablative laser treatments may minimize the appearances of finer wrinkles, ameliorate the texture and tone of the skin, and treat dyspigmentation. By comparison, the treatments are gentler and require little to no downtime, but produce a more moderate response.

Ultimately, a patient's needs dictate the selection of the ideal laser. In this review, we seek to demystify the differences between the many available lasers and thereby facilitate the identification of the most appropriate laser for the patient.

Ablative Nonfractionated Lasers

Ablative skin resurfacing removes the epidermal layer, producing the most dramatic laser-treated results for skin resurfacing. The lasers quickly superheat water molecules in the skin tissue. When the water turns into gas, the skin cells are vaporized in a precise skin-peeling effect. This effect promotes collagen formation and retraction of the dermis and

Issue Theme Cosmetic Laser Resurfacing; Guest Editor, Ramsey Markus, M.D.

DOI http://dx.doi.org/10.1055/s-0032-1329413.
ISSN 1535-2188.

Table 1 Ablative Nonfractionated Lasers

Wavelength & Type	Manufacturer & Product	Key Features
10,600 nm CO_2 laser	Sandstone Medical Technologies Matrix LS-40	Up to 100-ms pulses; 40 W; Ultrafine-FS fractional scanner available
	Lumenis UltraPulse & AcuPulse	Can be used in either nonfractionated or fractionated modes (see ►**Table 4**)
2940-nm Er:YAG laser	Focus Medical NaturaLase ER	3J; includes “microhex” fractional handpiece
	Quantel Derma GmbH BURAINE	350-µs pulses; up to 2 J energy; fractional handpiece available
	Sandstone Medical Technologies Whisper 3-G	300-µs pulses; 600 J/cm2; 1-/3-/6-/9-mm spot sizes
	Sciton Contour TRL	Up to 50-ms pulses; up to 40 W; tunable resurfacing laser (TRL); computerized scanner
	Syneron & Candela SmoothPeel	2-/4-/6-Hz pulses; up to 750 mJ energy; 5- and 9-mm spot sizes
Combined CO_2 ER:YAG laser 10,600 nm / 2940 nm	Sandstone Medical Technologies Cortex Resurfacing Work Station	Up to 100-ms pulses; up to 40 W; CO_2 portion is fractionated

epidermis to tighten the skin. These lasers were the original treatment developed for significantly improving photodamage and acne scarring and have remained the most effective treatment. The original devices had serious side-effect profiles including scarring and difficult wound healing; however, the most recent generation of ablative lasers—particularly the fractionated ablative lasers—have been able to reduce the trauma of the treatment and decrease downtime while still allowing for effective resurfacing. These lasers are much safer than earlier models, but they still retain a higher risk of potentially severe damage in the form of scarring, discoloration, and infections of the skin (►**Table 1**).[1]

Carbon Dioxide Laser

Laser skin resurfacing began with the application of the carbon dioxide (CO_2) laser to facial rejuvenation, initiating a new era in the field of photorejuvenation.[2] These first lasers allowed the physician more precision than was previously available with older dermabrasion and chemical peeling techniques. These first CO_2 lasers operated using a continuous wave (CW). While providing skin enhancement, the rates of side effects were high, including undesirable scarring. To increase control of how much and what type of tissue would be removed, short-pulse CO_2 lasers were developed. However, this technique was still ablative and retained a long 2-week recovery period.

The CO_2 laser emits light at the 10,600 nm wavelength. This wavelength is strongly absorbed by tissue water. When pulsed at less than 1 ms, the laser vaporizes tissue up to 20 to 30 µm per pulse. This limits the residual thermal damage (i.e., surrounding tissue heating effect) to a 100- to 150-µm layer of tissue. Small beams of 100 to 200 µm achieve rapid tissue vaporization, whereas beams larger than 2 mm induce nonvaporization and increase the risk of deep thermal damage. Concern over this possibility led to the development of high-pulsed or scanned CO_2 lasers to control the depth of ablation.

It is hypothesized that CO_2 lasers cause immediate contraction of the ablated areas by denaturing existing old collagen.[3] This stimulates new collagen, and collagen content continues to increase well after the procedure. As a result, the CO_2 laser systems work best at alleviating fine wrinkles, especially around the eyes or mouth.[2] Deeper wrinkles and creases are less completely removed. In addition to wrinkles, CO_2 lasers are also effective at alleviating acne scars[4] and atrophic scars.

Two main types of CO_2 lasers are in use today. The first is a high-power pulsed CO_2 laser, which operates at 1 millisecond or less (Ultrapulse). The physician can use the pulses manually at a 3-mm diameter, or they can activate the computer pattern generator. The second type uses scanning of a CW CO_2 laser (AcuPulse). Most of these scanning lasers are fractionated, a technology discussed in depth later. This second category uses computererized controls to ensure that no individual area receives treatment more than once. The scanning CO_2 lasers as well as other pulsed CO_2 lasers produce equivalent results, side effects, and histologic differences.[5] The equivalent results were confirmed when different scanning and pulsed CO_2 laser systems were used on different parts of the same patient's face.

The major long lasting side effect of nonfractionated CO_2 lasers is permanent skin hypopigmentation, although permanent hyperpigmentation can rarely occur.[6] Temporary hyperpigmentation is more common but transient depending on dose. The amount of hypopigmentation is related to the amount of injury supplied by the laser.[7] On the other hand, injury also correlates with the amount of wrinkle reduction,[8] the main goal of photorejuvenation therapy for many patients.

Using a modern CO_2 laser, such as the Coherent UltraPulse, physicians can expect an improvement of facial wrinkles by 45%.[6] All patients suffer from oozing, bleeding, crusting, and downtime postprocedure. Side effects, such as acne, hyper-, and hypopigmentation and infection are reported by 55% of patients, with the remainder being mostly asymptomatic.[6] Only a few cases of hypopigmentation can be expected as long-term side effects after a year.

Er:YAG Laser

The erbium-doped yttrium aluminum garnet (Er:YAG) laser was the next laser system to be developed. It emits light at the 2940-nm wavelength in the infrared range. This frequency is much closer to the peak absorption range of water and thus has an absorption coefficient 16 times greater than the CO_2 laser. This greater absorption decreases the penetration depth into the epidermis by a factor of ten. This is an advantage, as more precise ablation of skin is possible with even less damage to surrounding tissue.

Compared with CO_2 lasers, the Er:YAG laser has similar efficacy. However, the CO_2 laser is considered by some to be slightly superior although this is controversial.[9] This advantage is suspected to be due to better tissue tightening with the CO_2 lasers.[3] The Er:YAG laser has less severe side effects, with less postoperative edema and fewer days of crusting on the skin.[10]

Combined CO_2 Er:YAG

After the above two laser technologies were in use, doctors hoped to synergize the effects of the two systems. Studies have shown that using an Er:YAG laser after using a CO_2 treatment results in decreased side effects without a change in wrinkle improvement.[11] A combined, dual wavelength CO_2/Er:YAG laser also shows similar wrinkle improvement to CO_2 laser therapy alone.[12]

Nonablative Nonfractionated Lasers

Nonablative nonfractionated lasers entered the market in the late 1990s primarily for use in skin resurfacing. This class of lasers produces a gentler effect on the skin, inducing controlled tissue injury in the dermis and stimulating dermal remodeling and collagen production. The results of nonablative lasers are mild compared with their ablative counterparts, but patients seeking gradual improvement in their complexion often select this laser class because of the minimal recovery and side-effect profile. The potential damaging risks associated with nonablative lasers are significantly lower compared to ablative lasers.[13] The major benefit for these lasers is their significant reduction in downtime after a treatment compared with CO_2/erbium lasers. Patients experience as little as a few hours of erythema with no scaling or peeling of the skin. Four to six treatments are necessary for very moderate effects.[14] Some studies also indicate that the wrinkle improvement is limited and these lasers are now more often used for acne improvement.[15] Within the nonablative, nonfractionated class, lasers of ranging wavelengths offer different targeted treatment focused on textural improvements, acne treatment, and overall skin rejuvenation.[16] Patients with darker skin tones are also candidates for nonablative lasers as they do not induce the abnormal pigmentation that often arises with ablative laser use on darker skin (►**Table 2**).[16]

1319-nm Pulsed Energy Laser (Sciton Thermascan)

The 1319-nm pulsed energy laser resurfaces the skin to improve the appearance of wrinkles, acne and related scarring, skin tone, and texture.[17] Like other nonablative lasers, the 1319-nm pulsed energy laser thermally targets the fibroblasts that reside in the dermal layer to stimulate production of collagen. The 1319-nm pulsed energy laser is a member of the mid-infrared laser class, which is effective at treating fine facial wrinkles.[17] These lasers are not beneficial for treating pigment discolorations or vascular abnormalities, although they are designed to safely treat all skin types and shades.

This laser employs the large-area pattern generator (LAPG), an additional technology designed to evenly distribute the laser's path in a nonsequential fashion. In doing so, no region of skin becomes overheated, which could potentially lead to unwanted side effects. Moreover, the technology ensures that the targeted skin is treated completely and efficiently.

1320-nm Nd:YAG Laser (CoolTouch CT3Plus, Alma Harmony XL)

The long-pulsed 1320-nm Nd:YAG laser was the first nonablative laser to reach the commercial market. The 1320-nm Nd:YAG laser functions by avoiding damage to the epidermis and instead targeting the dermal layers to stimulate new collagen growth. The water in the skin absorbs the 1320-nm wavelength in particular, creating an even distribution of energy without damaging melanin or hemoglobin. As such, this laser is effective on all skin types I to VI without producing changes in pigment. This laser accelerates the productive capacity and vitality of fibroblasts in this layer as seen in its promotion of the two major secretory factors they produce: basic fibroblast growth factor (bFGF) and inhibiting transforming growth factor β1 (TGF-β1).[18] The

Table 2 Nonablative Nonfractionated Lasers

Wavelength & Type	Manufacturer & Product	Key Features
1319-nm Pulsed energy	Sciton Thermascan	5–200-ms pulses; 30 J/cm^2; 6-mm spot; nonsequential scanning to reduce heat buildup between laser pulses
1320-nm Nd:YAG	CoolTouch CT3Plus	450-μs pulses; 3–10-mm adjustable spot; burst & continuous modes
	Alma Harmony XL	Long-pulse; 5–40 J/cm^2; 6-mm spot
1450-nm diode	Candela Smoothbeam	210-ms pulses; 8–25 J/cm^2; 4- or 6-mm spot

laser actively reverses visible and histopathologic signs of skin aging as it stimulates collagen types I, III, and VII, and tropoelastin production.[19] The laser has been noted as safe and effective in the treatment of acne and related scarring by shrinking sebaceous glands and minimizing sebum production which prevents future acne lesions.[20] The literature reports mixed reviews of patient satisfaction with treatments for acne and scarring resolution.[21,22] Asian patients in particular have reported efficacy of this laser in reduction of wrinkles and acne scarring.[23]

1450-nm Diode Laser (Candela Smoothbeam)

The 1450-nm diode laser is effective for the treatment of facial acne as well as for improving the appearance of scarring.[24] The nonablative laser has been shown to dramatically and safely improve inflammatory facial acne by partially damaging sebaceous glands to reduce sebum secretions.[25] The 1450-nm diode laser has demonstrated greater scar response after treatment than the nonablative 1320-nm Nd:YAG laser; this quality has been particularly helpful for patients with acne scarring.[26] The laser is believed to achieve these results by targeting sebaceous glands in the upper dermis while sparing the epidermis, reducing downtime.[27] The laser focuses on the water in the skin, which is likely why the upper dermis is heated and therapeutically damaged.[28] Interestingly, the 1450-nm laser appears to induce a systemic effect on the skin, as treatment on only one side of the face in one 2011 study resolved acne lesions on both sides of the face.[29] Unfortunately, in our experience, subsurfacing laser technology has had limited improvement of facial wrinkling. Downtime is minimal and is restricted to temporary erythema, edema, and hyperpigmentation after treatments.[30] This laser achieves mild to moderate improvement of acne scarring in Asian patients without producing permanent pigmentary change even in darker skin types IV and V.[31,32]

Nonablative Fractionated Lasers

The nonablative fractionated lasers combine the best of the gentle and safe aspects of both fractionated and nonablative technologies, which entered the market in 2005. This class of lasers is aimed toward improving texture, mild to moderate wrinkles, and acne scarring as well as treating hyperpigmentation due to sun damage and aging. The neck, chest, and extremity regions are also safely and effectively responsive to these lasers. The lasers' fractional pattern assists with efficacy of the treatment as well as the safety and downtime profile.[20] Treatment requires a moderate amount of downtime with correspondingly moderate results. These lasers are also effective in darker-skinned individuals with less risk of discoloration as they induce limited tissue damage and melanocyte stimulation.[17] Treatment can be painful, and topic anesthetics are helpful for decreasing patient discomfort (►**Table 3**).

1410-nm Laser (Solta Fraxel Re:Fine)

This 1410-nm nonablative fractional laser was designed to resurface the skin, reducing the appearance of superficial rhytides. It requires ~3 to 5 treatments to see results with a minimal downtime of 3 to 5 days. The laser is safe on Fitzpatrick skin types I to VI, making it very versatile for a broad spectrum of patients. Fraxel pioneered the concept of fractionated lasers, coining the term microscopic treatment zones (MTZs)—or columns of thermal heating one-tenth the size of a hair follicle. These MTZs are dispersed throughout the treatment region, allowing some deep penetrating treatment while maintaining a rapid recovery rate as the epidermis is not compromised.

1440 Nd:YAG Laser (Cynosure Affirm and Palomar StarLux)

The 1440-nm pulsed laser improves the appearances of rhytides by microrejuvenation, which is brought about by the induction of microcolumns of even heating.[33] The StarLux system employs an additional cooling system to improve patient comfort while allowing for a higher power treatment, increasing efficiency. The Affirm laser distinguishes itself via its combined apex pulse (CAP) technology, which evenly distributes energy across a 300-µm depth, focusing the laser on the desired dermal skin layers. This laser also utilizes a cooling system for patient comfort.

1540-nm (PalomarStarLux 1540 and Palomar Icon) and 1550-nm Erbium Glass Lasers (Solta Fraxel re:store) and the Combination of 1550-nm Erbium Glass and 1927-nm Thulium Fiber Lasers (Solta Fraxel re:store DUAL)

The 1540- and 1550-nm erbium fiber lasers and the 1927-nm thulium fiber laser are fractional lasers with ablative and

Table 3 Nonablative Fractionated Lasers

Wavelength & Type	Manufacturer & Product	Key Features
1410 nm	Solta Fraxel re:fine	700 µm depth; 20 mJ / MTZ
1440 nm Nd:YAG	Cynosure Affirm	1,000 micro-pulses / 10-mm spot
	Palomar StarLux	Includes both 1440- and 1540-nm handsets
1540 nm	Palomar StarLux	Includes both 1540- and 1440-nm handsets
	Palomar Icon	Includes 2940 nm fractional ablative handset
1550-nm Erbium glass and 1927-nm thulium fiber	Solta Fraxel re:store and re:storeDUAL	1550 nm:1.4 mm depth; 70 mJ / MTZ 1927 nm:0.23 mm depth; 20 mJ / MTZ

MTZ, microscopic treatment zone.

nonablative capabilities that allow them to treat both epidermal and dermal skin imperfections. This laser class safely and effectively treats epidermal pigmentation, photoaging, melasma, rhytides, atrophic, surgical, and acne-related scarring and additional textural imperfections.[34–38] As with other lasers, the laser targets water in the dermis, gently heating it to cause controlled thermal tissue damage. The fractionated component of the laser allows for a spatially precise, regular pattern of columns of tissue injury to be created across the treated region, retaining the healing function of the epidermis even while targeting both skin layers. Through the fractionated treatment pattern that targets both the dermis and epidermis, these lasers provide the significant skin resurfacing capabilities of an ablative laser while retaining the downtime profile of a nonablative laser. However, because the laser can only target a fraction of the patient's skin at a time, more treatments are typically required at 2 to 4 week intervals for the best outcomes.[39]

Ablative Fractionated Lasers

The most recent generation of ablative lasers are the fractional ablative lasers. Their use started around 2007. These lasers have been able to reduce the trauma of the treatment and decrease downtime while retaining resurfacing power. These lasers are significantly safer than their nonfractionated counterparts, but they still retain a high risk of potential damage in the form of scarring, discoloration, and skin infection.[1]

Table 4 Ablative Fractionated Lasers

Wavelength and type	Manufacturer & Product	Key Features
10,600-nm fractional CO_2	Alma Lasers, Inc. Harmony Platform Pixel CO_2	Short/medium/long pulses; 300–2,500 mJ/p; multiple "pixel" tips
	Cynosure, Inc. SmartSkin	150–20,000-μs pulses; up to 30 W power; multiple scanning patterns
	DEKA SmartXide DOT 30 W/50 W	0.2-μs–80-μs pulse; 150 W to tissue; multiple scanning modes
	Ellman International, Inc. Elluminé Fractional CO_2 laser system	2–7-ms pulse; up to 105 mJ
	Focus Medical NaturaLase CO_2	Up to 10-ms pulse; 50 W
	Hironio Co., Ltd. MIXEL	Up to 5000-μs pulse; 60 mJ; 2- × 2- to 20- × 20-mm scan size
	ILOODA CO., Ltd. Fraxis	0.1–5-ms pulse; up to 30 W
	Lasering USA Slim Evolution II MiXto Pro	2.5–16-ms CW chopped pulse; 0.5–30 W; 180-μm or 300-μm spot size
	Lumenis Ultrapulse Encore (Active FX/ Deep FX/ Total FX)	<1-ms pulse; 240 W to tissue; Active FX mode with 1.3-mm spot size; Deep FX with 0.12-mm spot size; Total FX combining Active FX and Deep FX
	Lumenis AcuPulse MultiMode	CW scanning robot-assisted laser; 0.01–1.00-s pulse; 30 W and 40 W models available; 1.3-mm and 0.12-mm spot sizes in one handpiece
	Lutronic eCO_2	2–240 mJ; "controlled chaos technology" promotes heat dissipation
	Solta Fraxel re:pair	Up to 70 mJ/MTZ; "intelligent optical tracking system"
	Syneron & Candela CO2RE	60 W; 7 different treatment modes
2940-nm Fractional Er: YAG	Alma Lasers, Inc. Harmony Platform Pixel 2940	Short/medium/long pulses; 300–2,500 mJ/p; 11 mm^2 pixel tips
	INDUSTRA Technologies 2940 DualMode	300 μs to 5 milliseconds pulses; up to 60 mJ/mtz; provides both ablative and coagulative effects
	Palomar Icon Aesthetic System 2940 Fractional laser handpiece	0.25–5-ms pulses; 2–5.5 mJ / 0.1 mm
	Sciton ProFractional (XC)	Variable pulse; up to 400 J/cm^2
2790-nm Fractional Er: YSGG	Cutera Xeo Platform Pearl Fractional	600 μs; 60–320 mJ per microspot; greater than 1-mm ablation depth

MTZ, Microscopic treatment zone.

The main use of these lasers is for mild skin tightening to battle laxity and rhytides. However, these lasers can also treat photodamage, atrophic acne scars, hypopigmented scars, and dyspigmentation.[40] Overall, patients can expect moderate down time and moderate risk of complications.

Ablative CO_2 Fractional Laser (Lumenis UltraPulse Encore, Fraxel re:pair)

Fractional technology was first developed in use with CO_2 lasers. Side effects are rarer than with nonfractional lasers, and only a few cases of scarring following fractional CO_2 therapy have been reported.[41] The therapy may be just as effective, with one study showing 72% of volunteers having some improvement (with an average improvement of 40%), as well as 80% of volunteers reporting satisfactory reduction in visible wrinkles.[42]

The Lumenis UltraPulse Encore, released in 1998, is an advanced fractional CO_2 laser system with three modes of delivering the laser's energy. The first, Active FX uses a 1.3-mm spot size that ablates the superficial tissue and is useful for treating fine lines, actinic keratosis, and similar diseases. The second, Deep FX focuses the lasers energy into a 0.12-mm spot size and allows for deep ablation that is useful for treating deep rhytides. This mode can ablate up to 2 mm into the tissue. The Total FX mode uses both the Active FX and Deep FX modes simultaneously and is useful for treating scars and rhytides.

The Fraxel re:pair fractional CO_2 laser system works much like the Encore's Deep FX mode. The pulse duration on this laser can range from 0.15 to 3 ms. By using a short pulse duration, the laser system can deliver more energy quicker and ablate deeper. By combining its small 0.14-mm spot sizes and a short 0.15-ms duration, this laser ablates to depths of 1.6 mm. Other lasers in the Ablative CO_2 laser category do not have deep ablation like the Deep FX mode of the Encore and the Fraxel re:pair (see ►**Table 4**).

Ablative Er:YAG Fractional Laser

Fractional technology can be applied to Er:YAG lasers much in the same way that it was developed for CO_2 lasers. Similar to the comparison between nonfractionated CO_2 and Er:YAG lasers, the fractionated versions of these two laser types have similar postoperative and comparable cosmetic improvement.[40]

Radiofrequency

Radiofrequency (RF) systems are unique in that they are thermal heating systems, working more like microwaves rather than lasers. Current radiofrequency resurfacing systems are nonablative. They have the advantage of having a higher penetration depth, while aiming for collagen shrinkage and skin tightening. Another advantage is their relatively low operating temperature, as only the deeper tissue is heated. The RF largely passes through the skin surface, sparing it from heating (►**Table 5**).

Much like the laser systems, the RF systems achieve results by denaturing existing collagen and stimulating production of newer and shorter collagen, leading to lasting tissue tightening.[43] However, it has the added property of being able to heat the subcutaneous fat as well, leading to undesired visible fat reduction in some cases.[18]

This modality is presented here because this electrical energy is often combined with other modalities to achieve a synergistic effect. For example, radiofrequency has been combined with diode systems (Polaris WR) to achieve both clinical results by an impartial viewer and with patient satisfaction.[44] Of the 20 patients in this trial, none had any pigment changes or scaring; however, most suffered pain and all had erythema, while 80% had edema for 24 hours. Another study combined the three main nonablative modalities (IR, RF, and IPL), showing a 26% improvement on average and a 71% patient satisfaction.[45]

Table 5 Radiofrequency Systems

Wavelength & Type	Manufacturer & Product	Key Features
10,600-nm CO_2 laser, RF excited tube	Eclipse Aesthetics Equinox	0.05–10-ms pulse; 350-μm spot fractional scanner
Multiphase RF fractional sublative	Eclipse Aesthetics EndyMed Pro	70 ms per pulse, 6 W RF output
4.0 MHz high-frequency monopolar RF	Ellmann International, Inc. Pellevé Wrinkle Reduction System	Four handpiece sizes ranging from 7.5 mm to 20 mm
Radiofrequency	EndyMed Medical Ltd. EndyMed PRO / GLOW	65 W
Monopolar / Bipolar RF	ILOODA CO., Ltd. Lunar N	0–150 ms pulses; 75 W
Radiofrequency	Invasix Fractora	62 mJ/pin
Bipolar RF	Lumenis Aluma	1–5-s pulse; 2–20 W
Bipolar RF	Syneron & Candela ePrime	460 nm, 5 kHz
580–980-nm Optical/RF	Syneron & Candela eMax/eLight SR(A)	Up to 46 J/cm^2/up to 25 J/cm^2
900-nm Diode/RF	Syneron & Candela eMax/eLaser WRA	Up to 50 J/cm^2/up to 100 J/cm^2
1 MHz Fractional RF	Viora V-touch	50–200-ms pulses; up to 25 J

RF, Radiofrequency.

Conclusion

After review of these laser resurfacing technologies, clear trends arise. Most of the ablative technologies offer greater results, at the cost of longer recovery times and potentially more severe side effects. On the other hand, nonablative technologies usually offer more moderate results with fewer side effects and an easier recovery. Fractionated technologies seem to combine some of the best aspects of each category, with shorter recovery times, but results approaching those of fully ablative technologies with a series of treatments. Overall, this wide selection of technologies allows the physician options to provide the appropriate care for their patients.

Acknowledgments
No financial support was received during the completion of this article.
Jason Preissig and Kristy Hamilton contributed equally to this work.

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