

The Latest in Lasers

by Gregory T. Absten

Light based technologies have revolutionized aesthetic procedures and medicine. Lasers are at the pinnacle of these technologies because of their brightness and intensity, but significant improvements in a wide variety of cosmetic conditions are also afforded by other light sources such as **IPLs** (Intense Pulsed Light Systems), **LED** banks (Light Emitting Diodes), and other Low Level Light Therapy (**LLLT**) modalities. Anyone working in the field of aesthetics should have a good understanding of the basic principles behind laser and light based therapies whether or not you

are actually treating clients with these devices because they impact so many conditions in so many people.

Even though you'll find a steady evolution of the lasers and delivery devices into more user-friendly and ergonomic devices, most of the latest advances in the last couple of years have come from a realization that it is combinations of "cocktails" of different modalities of treatments that are making the most remarkable improvements in skin conditions rather than one particular type of laser treatment alone. Combinations of various laser modalities with some

drug therapies, skin care, and cosmeceuticals can produce results that surpass the sum of their individual parts. As only one example, skin rejuvenation in clients with sun damage and acne can be pre-treated with microdermabrasion to enhance topical drug delivery and surface optics of the skin, then followed with the application of the **photosensitizing** drug levulan, activated with blue light and further treated with pulsed dye or copper bromide laser yellow light, followed by a consistent regime of skin care and cosmeceuticals.

On the technology side the greatest practical advancement in lasers over the last few years has been the modularization of devices so that the user can buy one device that has several different laser or IPL modalities available from the same machine, and allows them to upgrade or change at any point in time. This is important because there is no single "best" laser or light source for all aesthetic procedures. Each laser has its own strengths even though there is some overlap in types of applications among the various laser wavelengths. You can't get just one device that will do everything so you must choose the application(s) that are most important to you. Modular devices allow you to economically expand the application

base in your practice. A large practice that can justify multiple lasers could conceivably incorporate a dozen or more types of lasers and other light sources into their practice to treat all conditions.

Some units are completely modular in that the configuration can be changed on demand, and other manufacturers simply incorporate multiple wavelengths into their units as a fixed configuration. There are many choices. Examples would include the combination of 532nm and 1064nm for skin rejuvenation, pigmented lesions, hair removal, and leg veins; the 511nm and 578nm combinations for pigmented

lesions, vascular lesions and skin reju-

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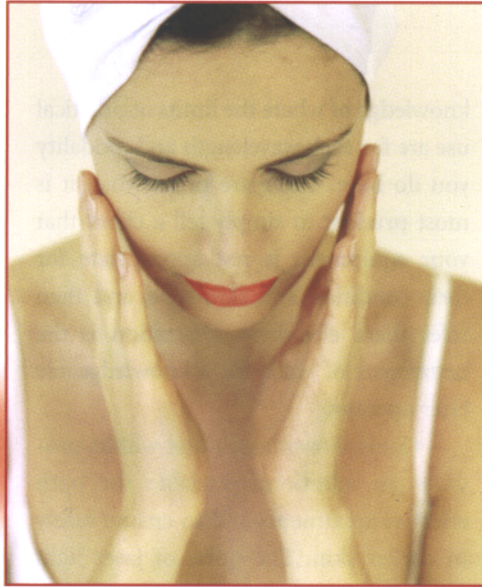
venation; 2940nm and 10600nm combinations for superficial but hemostatic ablative skin resurfacing with deeper skin rejuvenation; combining various laser wavelengths with broadband IPL wavelengths for multiple applications; and even combining laser or IPL with

Type of Lasers	Color/Wavelength	Typical Applications
CO2	Infrared 10,600nm	Ablative Skin Resurfacing
Erbium: Yag	Infrared 2,940nm	Ablative Skin Resurfacing
Diode Lasers	Variable Infrared 800-1500nm	Skin rejuvenation, Hair Removal, Veins
Neodymium: Yag	Infrared 1064nm	Hair Removal, Skin Rejuvenation, deeper leg veins
Alexandrite	Infrared 755nm	Hair Removal, Veins
Ruby	Red 690nm	Hair Removal
Continuous Dye Laser	Red 630nm	Photodynamic Therapy with photosensitizing drugs
Pulsed Dye Laser	Yellow/Orange 585-605nm	Vascular lesions- port wines, telangiectasia, etc. Skin rejuvenation, Rosacea
Copper Bromide	Yellow 578nm Green 511nm	Vascular lesions & skin rejuvenation as above. Pigmented lesions-age spots, freckles, etc..
Krypton	Yellow 577nm Green 514nm	Vascular & pigmented lesions as above.
KTP (Potassium Titanyl Phosphate)	Green 532nm	Small vascular lesions Pigmented lesions as above
Diode Laser	Green 532nm	Same as the green above

radiofrequency (RF) energy to enhance the selective heating effects.

Another trend in lasers is to move toward larger spot sizes. This cuts treatment times, increases client turnover and is generally more profitable. Larger spots are also more effective. IPL's have the largest "footprint" or spot diameters – some up to 15mm x 45mm. IPL's are good for many applications but as a general rule do not have the high degree of specificity of a laser. Most lasers have hand pieces that will allow up to 10 to 18mm spots. The larger the spot that is used, the more laser energy that is required to maintain the clinically effective dose of light within that spot. That's why larger spot capability lasers generally cost more than smaller spot counterparts.

The basis of most aesthetic laser



procedures such as laser hair removal, treatment of small vascular lesions (red or blue), acne, pigmented lesion removal or nonablative skin rejuvenation is the controlled induction of heat into the target tissues from the specific wavelength (color) of laser light. The heightened

specificity of laser light to these targets comes from a principle known as selective photothermolysis. Certain colors of targets (dark hair follicles, red blood vessels, etc) selectively absorb certain colors of light to generate heat within that target, while adjacent non-pigmented skin does not absorb it. For instance yellow light is best absorbed by oxygenated hemoglobin in blood vessels to treat small red capillaries. Green light is highly absorbed by melanin and so it is used for pigmented lesions.

There is some overlap in applications shown in the table on page 68 and it is not all inclusive, but it gives you a simplistic look at the types and colors of various lasers and their predominate applications:

It should be noted here that this lists the technical names of the lasers

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– what they actually are. Manufacturers however have predominantly resorted to using strictly marketing names for lasers in lieu of the actual name. This can make it confusing to keep track and there are far too many names to even attempt to list here. Please remember that these are only marketing names and the user should know what the underlying lasers or light sources are.

A general principle is that the longer the wavelength of the light (i.e. infrared outputs from diode or Nd:Yag lasers) the deeper the penetration and heating into the skin. Deeper veins require longer wavelengths. Dark skin becomes very

knowledge of where the limits of practical use are for each wavelength and modality you do have. There are times when it is most prudent to simply tell a client that your equipment is not appropriate for their condition and skin type, and then refer them elsewhere. Discretion is the better part of valor for a knowledgeable laser operator.

Control over laser pulse widths provides an additional variable for both effective treatments and to ensure safety in darker skin. The pulse of laser light must be delivered in a short enough period of time so that the resulting heat cannot escape from the targeted tissue

increased to compensate for this long pulse time. A method of external cooling of the skin becomes critical at these high dosages.

Adjunctive external skin cooling is essential with all of these laser and IPL modalities. The art of effective aesthetic laser application is a fine balancing act of creating just enough heat to damage the target without excessive heating of the skin, which creates burns. Wavelength selection and pulse width control are the first tools in this balancing act, and external cooling provides the final control. Cooling devices can be separate stand-alone devices or incorporated into the laser hand pieces themselves. Four different approaches can be taken which include application of chilled gels to the skin, use of contact cooling devices (chilled sapphire plates to treat through, copper plates to pre & post chill), a cold air chiller that blows ice cold air onto the client's skin, or cryogen sprays that are incorporated into the hand piece and computer controlled with the laser pulse. Remember that it is a balancing act. If you excessively chill the skin to a deep enough level you will protect against inadvertent burns, but you'll also reduce or eliminate the effectiveness of the treatment. In other words you'll spare the target along with the skin.

Nonablative skin rejuvenation is the most generic of all these light-based treatments and involves a very slight heating deep within the dermis just enough to create a minor inflammatory response. The subsequent healing process enhances the underlying collagen and fills out the skin. It is a process that takes many treatments over time but has virtually no down time for the client because at most they just turn a little red. With such generalized deep heating it's no wonder there are so many modalities

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problematic because its melanin absorbs a broad range of wavelengths and the risk of burning the skin becomes very high. Shorter wavelengths are the worst. Longer wavelengths such as the Nd:Yag laser at 1064nm coupled with longer pulse widths of energy delivery and external skin cooling are commonly used to prevent burns and achieve good cosmetic results. Utilizing the shorter wavelength 755nm Alexandrite laser for hair removal in a dark skinned (or even sun tanned) client would most likely result in blistering of the skin because of the high degree of absorption by the melanin, even though that wavelength might be perfect for a skin type III Caucasian. Herein lies one of the ethical dilemmas in running a successful aesthetic laser practice. Unless you can afford to incorporate many modalities into your practice, you can't treat everyone and you must have a good working

before it is thermally destroyed. This time is known as the thermal relaxation time of tissues. If your laser pulse is long enough at a given dose of light, then the structure (i.e. capillary blood vessel, hair follicle, freckle) begins to dissipate that heat and survives. Delivering the same therapeutic dose in a pulse shorter than this time essentially overwhelms the structure with the heat and it dies. Short pulse widths are effective clinically but they result in increased client discomfort and can create skin burns, especially on dark skin. Longer pulse widths are not as effective but are "safer" on darker skin. Previously a 100-millisecond pulse was considered a very long pulse on most aesthetic lasers, but some units are now allowing pulse widths of 400-500 milliseconds. Ordinarily that would decrease the effectiveness of the treatment but the dosage of the light is significantly

that will work: IPL's, yellow light, infrared light and even Radio Frequency induced heating. These are all noninvasive and are primarily performed by nonphysicians where allowed by law.

Ablative skin resurfacing produces the most dramatic improvements but has the highest downtime for the client because of recovery from the "controlled burn". It's the healing process that creates new skin. Because of the invasiveness of these procedures physicians always perform them. CO₂ and Er:Yag lasers are primarily used, and a new procedure called Fractional Ablation significantly reduces client downtime while retaining the dramatic improvements.

There are other modalities we don't have time to discuss here, but one of the most potentially widespread applications over the long term is the use of Low Level Light Therapy to induce various rejuvenative metabolic processes without the initial insult of inflammation. Using small low power light sources of different types including lasers, terminology such as photomodulation, biostimulation and "soft" or "cold" lasers have all been used to describe the therapy. It is emerging as a major therapeutic modality in the healing arts community, and may eventually see widespread home use.

Remember that manufacturers will supply treatment protocols that give you a starting point for laser settings. Since everyone reacts a bit differently you should do some test shots and wait to see the skin reaction, and then adjust accordingly. Learning the basics of aesthetic laser procedures is not difficult but does require the effort to learn some basic energy, tissue interaction, and safety concepts.

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Lasers Q & A: True or False

by Kile Law

How much do you really know about aesthetic lasers?

Test your knowledge with this True or False Quiz

- 1. Q** Full leg laser hair removal can be performed in 20 minutes?

A. True – It used to take upwards of three hours to perform laser hair removal of the legs. Now, hair removal lasers are equipped with more hertz (what make a laser go) and larger (18mm) spot sizes that cover more area. This change has made laser hair removal much more appealing to individuals seeking removal of unwanted hair.
- 2. Q** Lasers eliminate signs of rosacea?

A True – There are lasers that can eliminate the constant redness and flushing of the skin, and can remove existing telangiectasias (spider veins) of the face. However, laser treatment should not be promoted as a permanent cure for rosacea. Rosacea tends to be genetic and therefore may resurface years after treatment. Minimizing sun exposure after successful laser treatment can significantly decrease the possibility of future rosacea outbreaks.
- 3. Q.** Laser hair removal requires the use of a topical anesthetic?

A. False –Dynamic cooling technology is a method of cooling and protecting the skin. Immediately before the laser pulses, a quick spray of cryogen cools the skin to provide a temporary “numbing” to the treated area. There is minimal discomfort associated with this type of treatment and is both safer and more effective than topical numbing preparations for providing comfort during laser treatments.
- 4. Q.** Laser hair removal can never be performed on tanned skin?

A. False – The long pulsed Nd:Yag laser has a much deeper wavelength than other hair removal lasers, so there is little scattering of the laser energy. This allows for a safe and effective treatment for all skin types – including skin that is dark or tanned. However, sunburned skin should never be treated with any laser and skin that has recently been treated with a laser should not be exposed to excessive sun.
- 5. Q.** Lasers can tighten skin without downtime?

A. True- Non-ablative lasers actually bypass the epidermis to target the deeper layers of the skin leaving the outer layers intact. The thermal energy affects the dermal layers to stimulate collagen production resulting in tighter skin and improved elasticity. Resurfacing lasers, on the other hand (CO2 or erbium lasers) completely remove the epidermis requiring a significant recovery period. Clients should be informed that following a treatment with a non-ablative laser that the skin may be red for several hours and that mild edema (swelling) may last several days. Typically, a series of treatments with a non-ablative laser is required to achieve the desired result.
- 6. Q.** Lasers can do everything plastic surgery can do?

A. False –One of the most exciting recent developments in aesthetic laser technology is the introduction of lasers that can tighten and rejuvenate the skin of the body. However, these lasers will never replace plastic surgery. For instance, most women over 40 would like the skin of their thighs and knees to be firmer and sleeker. Skin tightening lasers are ideal for those who would like an improved texture and appearance but are not ready for an invasive surgical treatment like a thigh lift.
- 7. Q.**The ideal laser should have multiple applications such as laser hair removal, vascular lesion treatments, skin tightening and acne. One laser can do everything?

A. False – Every laser has a specific wavelength and chromophore (target). Although some lasers may have more than one application, there is no one laser that does everything, or at least that does everything well.
- 8. Q.** Laser hair removal can be the most profitable service in a medical spa?

A. True – Hair removal lasers are more effective, safer, and faster than they have ever been before. Demand for laser hair removal continues to increase. Faster lasers mean more treatments can be performed each day, resulting in more revenue for the spa.

Kile Law is a board-certified plastic surgeon and co-owner of Blue Water Spa located in Raleigh, N.C. In 2006, Kile will begin providing training to physicians and others interested in running successful medical spas. For more information on Blue Water Spa please contact lisa@bluewaterspa.com.