



Lasers & Light Therapies for Skin Rejuvenation

by Stacey Saito Tull, MD & Saadia Raza MD

There are numerous laser and light technology instruments for cosmetic improvement of skin appearance.



Stacey Saito Tull, MD, MPH, MSMA member since 2007, and Saadia Raza, MD are Co-Directors of the Skin Surgery Center of Missouri in O'Fallon. Contact: www.sscmissouri.com

Abstract

There are numerous laser and light technology instruments for cosmetic improvement of skin appearance. New technology is constantly being developed to improve cosmesis, shorten recovery and reduce risk.

Introduction

There is a myriad of technologies available to address nearly any concern that patients may have regarding their skin. Lasers and light source treatments offer non-surgical options for rejuvenation including improvement of the skin's texture and tone. These procedures are often performed as a series of treatments in the physician's office with little or no downtime or pain. Technology is available to reverse sun damage including age spots and redness, remove unwanted broken blood vessels, and tighten the skin to minimize the appearance of wrinkles or acne scars.

Treatments to Address Redness and Unsightly Blood Vessels

One of the most common indications for laser therapy is the reduction in the appearance of unsightly blood vessels, such as with rosacea, telangiectasias, spider

veins and cherry angiomas. Less common indications include vascular malformations, such as port wine stains and hemangiomas. Fortunately, there are multiple safe and effective modalities to address these cosmetic problems. These conditions generally require a series of treatments in order to achieve the optimal results.

The pulsed dye laser (PDL) has a 585 or 595 nm wavelength and is specific for use on blood vessels. It is one of the earliest lasers used for the treatment of vascular lesions (See Figure 1). Fortuitously this laser targets the absorption peaks of oxyhemoglobin, making it very effective.¹ Due to its shorter wavelength, it delivers more energy to the superficial vessels, and often causes purpura, which may result in a longer post-operative recovery. The development of devices to cool the epidermis have allowed the PDL to safely treat structures deeper in the skin, but caution must be exercised, particularly in patients with darker skin types, including tanned patients.

The Neodymium:Yag (Nd:Yag) is a 1064 nm wavelength laser and is also very effective for the treatment of vascular lesions. The Nd:Yag is preferable to the PDL lasers due to the ability to treat deeper vessels and not result in as much purpura. Due to its longer wavelength it tends to spare

Figure 1

Typical results before (left) and after 2 treatments of Nd:YAG laser for rosacea (right).



the epidermis and is safer in darker skin types. The 1064 nm lasers are safe enough to use for laser sclerotherapy and the ablation of leg spider veins.

A third laser device is the intense pulsed light (IPL). It involves a series of cut-off filters which are interchangeable in order to maximize the treatment of specific lesions. This feature makes the treatment with IPL devices especially operator dependent. Although not appropriate for deeper lesions, IPL is effective for rosacea, particularly when done in serial treatment. Besides reducing erythema, IPL treatment often reduces the appearance of brown spots. The IPL devices have large heads, or spot sizes, which allows a single treatment to be completed relatively quickly.

Treatments to Address Age Spots and Pigment

Another common complaint amongst patients seeking laser therapy is facial pigmentation including melasma and age spots (solar lentigos). The target in sun spots and most pigmented lesions are melanosomes.² There are multiple laser and light devices for the reduction of pigmented lesions, including ablative and non-ablative techniques. In this section we shall discuss the non-ablative methods.

The primary modality used for non-ablative treatment of diffuse epidermal pigmentation, is the intense pulse light (IPL) device. Again, the IPL tends to be very operator dependent, since the improvement is partially dependent upon the choice of the cut-off filter. The most commonly used filter for pigmented lesions is the 515 nm filter. The treatment results in an immediate darkening of the lesions which then slough off over the next several days. As with most laser treatments, this often requires multiple treatments.

In addition to facial rejuvenation, the IPL is also a very safe and effective modality for the treatment of sun spots on the neck/chest and the back of the hands. It

is important to remember that these areas do not have as many pilosebaceous units as facial skin and are more susceptible to thermal injury. It is important that an experienced operator meticulously control the laser energy and use an appropriate cooling device.

Treatments for Skin Tightening

Numerous laser technologies exist to treat skin laxity. These lasers exert their effect by targeting water containing tissue. This causes a thermal injury in the dermis which in turn results in collagen shrinkage and remodeling. The primary dividing line amongst them is whether the result is achieved with ablation (breaking the top surface of the skin) or not. This distinction not only determines the potential downtime and risk profile, but also the extent to which the skin can be tightened.

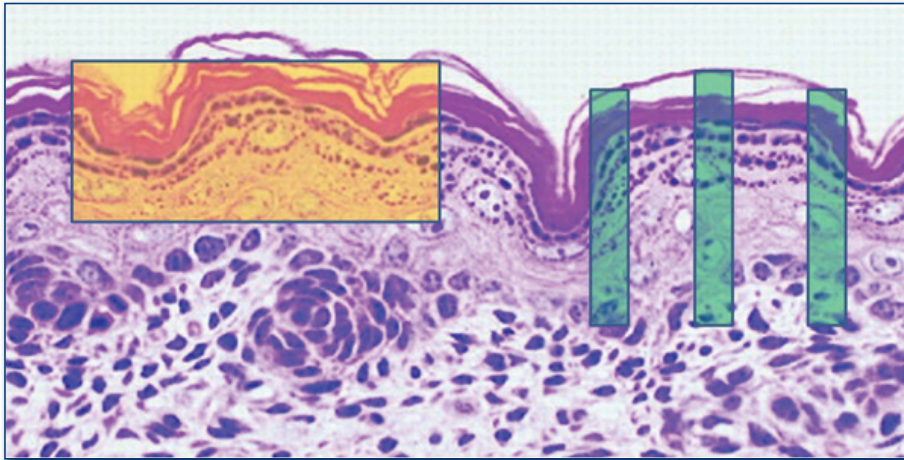
Non-Ablative Treatment Modalities

Radiofrequency (RF), ultrasound (US), and infrared (IR) light modalities all work by targeting dermal collagen.³ These technologies produce thermal effects in the dermis while avoiding cutaneous wounding via epidermal injury. Indications for RF/US/IR based rejuvenation include laxity of the skin on the face, neck, or body. Response to treatment is variable; improvement is often only seen after multiple treatments, and repeat treatments may be needed to maintain results. The benefits of these non-ablative technologies are: no downtime, most skin surfaces can be treated such as the neck, chest, areas with stretch marks; and are completely non-invasive.

Fractional photothermolysis was first introduced in 2004.⁴ Fractionated lasers create microscopic columns of coagulation through the epidermis and dermis eliciting a wound healing response (See Figure 2). Compared to traditional resurfacing, where the entire surface of

Figure 2

Typical surface area and depth of laser energy penetration for traditional resurfacing (left) as compared with fractionated resurfacing (right).

**Figure 3**

Severe rhinophyma before (left) and after (right) 3 treatments of fractionated ablative Erbium:YAG resurfacing.



the skin is ablated, fractionated lasers leave untreated areas of normal skin between the columns. This not only minimizes pain during the procedure, but shortens healing time. Because the non-ablative fractionated lasers heat, but do not ablate, the skin there is little or no effect on the skin surface⁵. This translates to minimal down time with the effect being similar to sunburn. Indications for non-ablative fractionated lasers include mild acne scarring, mild wrinkling, and especially melasma or hypomelanosis. As with most lasers, but in contrast to traditional resurfacing, fractionated lasers are often done in series in order to achieve a progressive clinical response.

Ablative Treatment Modalities

Traditional Resurfacing

Lasers long ago replaced dermabrasion. Until the advent of the fractionated lasers, traditional laser resurfacing was the gold standard. The entire surface

of the skin was ablated using a water-targeting CO₂ or Erbium:YAG laser. A response similar to a second degree burn was produced; such procedures often required sedation; recovery took weeks to months. Because the entire surface of the skin was affected, it was limited to individuals with fair complexions. Even in these skin types permanent relative hypo-pigmentation often developed. With the new generation of fractionated laser technology, fewer patients are choosing traditional resurfacing.⁶ There are still some indications for full surface ablation. For instance, traditional resurfacing is especially beneficial in treating the wrinkles around the eyes. In this area, the skin is thinner, requires less aggressive resurfacing, and elicits a superior result in one treatment that would require a series of fractionated laser

treatments. Both treatment types would require the same amount of down time (about one to two weeks) due to swelling.

Fractionated Resurfacing

Ablative fractionated lasers are the newest form of laser technology. They incorporate the effectiveness of the CO₂ and Erbium:YAG lasers with the benefit of fractional photothermolysis by creating fully ablative columns of microthermal injury. While producing more “down time” than their non-ablative counterparts, the cosmetic improvement is more apparent and achieved in fewer treatments. Because the surface of the skin is affected, one can expect transient pin-point bleeding (usually lasting less than 24 hours) followed by a severe sunburn type reaction for several days up to one week. Because much of the skin’s surface is left intact, however, patients are free to apply make-up or concealer after 1-2 days. For many conditions, such as moderate to severe



The Missouri Dermatology Society is committed to advancing the science of medicine and surgery related to promoting a lifetime of healthier skin, hair, and nails.

Missouri Dermatological Society

Stacey Tull, MD, President
 969 North Mason Road Suite 200
 St. Louis, MO 63141
 Phone: 314-996-8810
 Fax: 314-996-8774
 sftull@charter.net

Jill Watson, Executive Director

C/O Metropolitan Medical Society
 of Greater Kansas City
 315 Nichols Road, Suite 250
 Kansas City, MO 64112
 Phone: 816-531-8432
 Fax: 816-531-8438
 jwatson@metromedkc.org

Table 1

Commonly used laser and light therapies, indications, and relative effectiveness.

	PDL/Nd:YAG	BBL/IPL	Non ablative non fractionated	Non ablative fractionated	Ablative non fractionated	Ablative fractionated
Redness/vessels	+++	++	-	-	-	-
Sun/age spots	+	+++	-	++	+++	++
Skin laxity	+	+	+++	+	++	+
Skin texture	+	+	+	++	+++	+++
Downtime	-	+/-	-	+/-	+++	++

sun damage and wrinkling, moderate to severe textural abnormalities such as rhinophyma (See Figure 3), moderate to severe acne scars, as well as traumatic or surgical scars, the ablative fractionated lasers have surpassed traditional resurfacing in efficacy while minimizing downtime, side effects, and complication risks⁷.

Conclusion

There are numerous laser and light technology instruments for cosmetic improvement of skin appearance. New technology is constantly being developed to improve cosmesis, shorten recovery and reduce risk.

Table 1 highlights the types of treatments described in this article, as well as their relative effectiveness in treating various lesions.

Further information on these treatments can be obtained from the American Society for Dermatologic Surgery website at www.asds.net.

References

1. Kim KH, Rohrer, TE, Geroneumus RG. 2005 Vascular Lesions. *Laser and lights*, Vol 1: 11-27.
2. Iyengar V, Arndt KA, Rohrer TE 2005. Laser Treatment of Tattoos and Pigmented Lesions. *Surgery of the Skin Procedural Dermatology*: 599-609.
3. Dierickx, C. The role of deep heating for noninvasive skin rejuvenation. *Lasers Surg. Med.* 38:799-807, 2006.
4. Manstein D, Herron GS, Sink RK, et al. Fractional photothermolysis: a new concept for cutaneous remodeling using microscopic patterns of thermal injury. *Lasers Surg Med* 2004;34:426-38.
5. Alexiades-Armenakas MR, Dover JS, Arndt KA. The spectrum of laser skin resurfacing: nonablative, fractional, and ablative laser resurfacing. *J Am Acad Dermatol* 2008;58: 719-37.
6. Alster TS, Tanzi EL. Laser skin resurfacing: ablative and nonablative. In: Robinson JK, Hanke CW, Sengelmann RD, et al., editors. *Surgery of the Skin*. Philadelphia: Elsevier; 2005. p. 611-24.
7. Taub A. Fractionated delivery systems for difficult to treat clinical applications: acne scarring, melasma, atrophic scarring, striae distensae, and deep rhytides. *J Drugs Dermatol.* 2007 Nov;6(11):1120-8.

Disclosure

None reported.

