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Cosmetic Laser Procedures in Latin Skin

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ABSTRACT

Hispanics/Latinos are one of the fastest growing segments in the skin of color population in the United States. Utilization of lasers especially in people with skin of color requires a thorough understanding of laser physics and laser tissue interactions. In this article, we will outline the different lasers used in our practice based on each chromophore. Pretreatment recommendations as well as management of complications will also be shortly discussed. Our goal is for the readers to grasp the importance of proper device selection, understand the concept of selective photothermolysis, and the various treatment parameters required for optimal safety and efficacy.

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INTRODUCTION

Defining Skin of Color

Defining skin of color in the Latino population can be particularly challenging as it encompasses several cultural and historical aspects. In general, skin of color identifies racial groups with darker skin hues other than that of white skin. The five racial categories defined by the U.S. Census Bureau are American Indian or Alaska Native; Asian; Black; Native Hawaiian or Pacific Islander; and White. The Hispanic population is estimated to rise from 55 million in 2014 to 119 million in 2060, an increase of 115 percent. By 2060, 29 percent of the United States is projected to be Hispanic—more than one-quarter of the total population.[1] This increase in population becomes pertinent as it follows with an increase in demand by people with mixed color tones for dermatologic laser procedures. Most of the current medical literature on cosmetic laser procedures has been devoted to individuals with fair skin tones (Fitzpatrick skin phototypes <III). One study determined that the most common skin problems affecting this group are photoaging, facial melasma, hyperpigmentation, acne vulgaris, and eczema/contact dermatitis.[2] The Latino population runs the gamut of Fitzpatrick phototypes and must be considered as a "one size does not fit all approach". Several ways to define skin of color as well predict higher risk patients have been described. We will refer to the Fitzpatrick phototypes throughout the article. Although general skin tone color may provide a good prediction about the potential for hyperreaction to lasers, we also use a simple, yet effective additional screen in the office: palmar and digital crease pigmentation. First described by Hector G. Leal-Silva MD of the Institute of Dermatology and Cosmetic Surgery, Monterrey, Mexico, the screen divides patients into four groups, depending on the concentration of pigment present in their palmar creases (Figures 1 and 2). The palmar and digital crease color hue is a way to predict the propensity of various Fitzpatrick phototypes to experience post-inflammatory hyperpigmentation. The scale ranges from 0 to 3, with the highest number indicating a darker skin tissue response despite skin phototype.[3] In general, a provider must be cognizant of their patients with mixed color tone in order to properly consult and discuss realistic expectations as well of potential risks.

FIGURE 1. Palmar and digital crease pigmentation as a predictive risk factor for developing post inflammatory hyperpigmentation.[3]

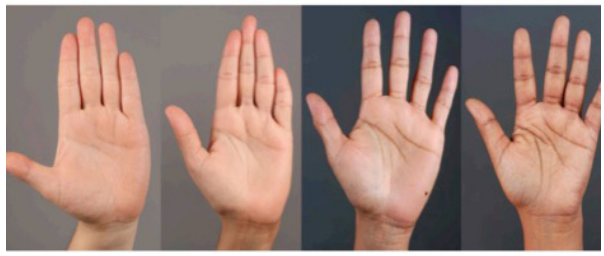
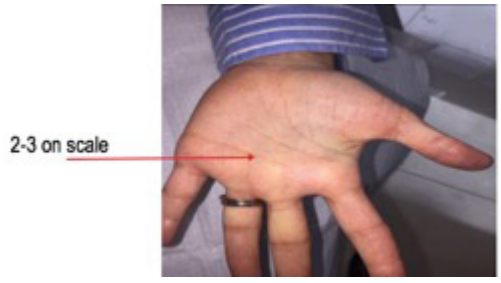


FIGURE 2. A depiction of scale 2-3 of palmar and digital crease color scale suggesting a medium to high risk of developing post inflammatory hyperpigmentation.



Pretreatment

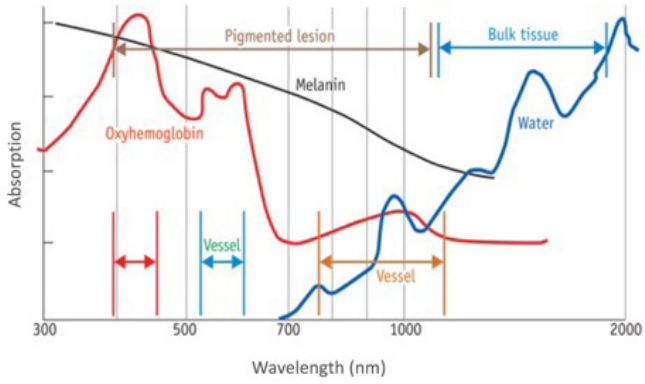
Safe treatment starts with a thorough pretreatment. We believe it is better to avoid laser procedures during the summer, when skin is at its darkest and there is a higher risk for sun exposure after treatment. A thorough history is obtained including history

of hyperpigmentation due to other traumas, allergy to lidocaine, personal or family history of photosensitizing conditions (ie, lupus erythematosus), herpes simplex, and recent intake of tetracycline or isotretinoin. Strict photo avoidance is discussed as well as protective measures including application of >SPF60 and oral sun protective supplement intake such as Heliocare, an oral extract of the Polypodium leucotomos fern. We also recommend a 6-week regimen aimed at lightening the area to be treated. The pretreatment regimen includes the application of hydroquinone 4-8%, the Miami Peel (modified Jessner's with kojic acid and hydroquinone), and/or Kligman's formula. A test-spot with follow-up in 2-4 weeks is also encouraged one month prior to treatment. Lastly, antiviral and antibiotic therapy is prescribed to the patient depending on laser device and treatment location.

Laser Science

The main principle describing the use of laser therapy is the concept of the target chromophore (Figure 3). A chromophore is a substance that absorbs specific wavelengths depending on its absorption coefficient. The three main endogenous chromophores targeted in lasers procedures are melanin, hemoglobin, and water. Melanin and hemoglobin are major chromophores for visible and near-infrared light while water is a major chromophore for far-infrared spectrum. For tissue damage to ensue, a wavelength should be preferentially absorbed by the chromophore in the target tissue and not the surrounding tissue, which may cause undesired effects (ie, dyspigmentation, scarring). To ensure maximized heat delivery to the target chromophore and the least risk to surrounding tissue, the wavelength delivered in a pulse duration should be less than or equal to the thermal relaxation time (TRT) of the target, a principle known as selective photothermolysis.[4] There are several laser parameters that when taken into consideration can attenuate the risk of hyperpigmentation and scarring, especially in mixed color tones. These parameters include longer wavelengths, longer pulse duration, lower fluence, lower densities (MTZ/cm2), efficient cooling (pre, concurrent, post) and smaller spot size.

FIGURE 3. Absorption spectra of different chromophores lasers can target using selective photothermolysis.



Chromophore: Hemoglobin

Vascular lasers, when used at the appropriate setting, can treat both light and dark skin tones in the Latino population. The main vascular chromophore is oxyhemoglobin. Darker phototypes (IV–VI) have more epidermal melanin that acts as a competitive chromophore against hemoglobin and oxyhemoglobin, therefore caution must be taken when targeting vascular lesions. Table 1 outlines the lasers we use in our practice for vascular lesions following with a discussion of selected lasers and skin conditions.

TABLE 1.

Laser and Light Devices Used in Practice that Target Vascular Lesions and Respective Wavelengths	
Pulsed dye laser	(585, 590, 595, 600nm)
Intense pulsed light	(400 to 1200nm)
Neodymium:yttrium aluminum garnet	(Nd:YAG) (532, 1064nm)
Long-pulsed alexandrite	(755nm)
Long-pulsed diode laser	(810nm)

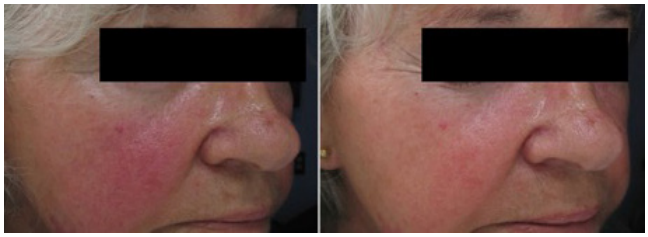
Pulsed Dye Laser

The pulsed dye laser (PDL) is a treatment of choice for vascular lesions such as telangiectasias. The 585nm wavelength pulsed dye laser penetrates to a desired depth of approximately 1.2 millimeters (mm). The longer 595nm wavelength allows for a slightly deeper penetration; however, the absorption coefficient of oxyhemoglobin is 3 times higher at 585nm than 590nm. In our opinion, the 585nm pulsed dye laser is superior in treating the vascular lesions such as port wine stains. In addition, both wavelengths are suitable for lighter complexioned skin tones (phototype IV and lighter). For darker phototypes V and VI, longer wavelengths should be utilized for treatment of vascular lesions. In addition, longer pulse durations should be used as it is safer in darker-skinned individuals. Treatment recommendation for rosacea with telangiectasias include 515nm with pulse duration between 12-15 (milliseconds) ms or higher. Alternatively, rosacea with telangiectasias and pigmentation require 570nm with pulse duration between 12-15ms or 500-600nm with pulse duration between 12-15ms.

Intense Pulsed Light

While there are many Intense Pulsed Light (IPL) devices available, the newer generation of IPL devices are as safe and effective as lasers in the management of skin conditions in darker skin tones. The patient's skin phototype and skin condition will determine the choice of suitable cut-off filters and therefore the spectrum of wavelengths to be emitted. The same principles that apply to lasers to reduce the risk of hyperpigmentation after treatment are also true with IPL. Figure 4 depicts improvement of vascular and pigmented lesions using the IPL device.

FIGURE 4. Before and after image of a Latina woman showing improvement of her vascular and pigmented lesions after one session the intense pulsed light (IPL) device.



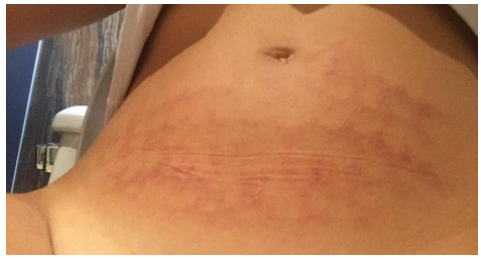
Chromophore: Melanin

Although there is no difference in the melanocyte density between Fitzpatrick phototypes, there is certainly an increase in the number and size of melanin granules within the basal layer keratinocytes in darker-skinned individuals. This large amount of melanin within the epidermis of darker skin types competitively absorbs laser light targeted for other chromophores. Subsequently, with the broad absorption spectrum of melanin, ranging from 250 to 1200nm, greater care and diligence must be taken when using lasers on Latino skin. A selective window for targeting melanin lies between 630 and 1100 nanometers (nm), where there is desired skin penetration and preferential absorption of melanin over oxyhaemoglobin. Absorption for melanin decreases as the wavelength increases, but a longer wavelength allows deeper skin penetration. Shorter wavelengths (<600nm) damage pigmented cells with lower energy fluencies, while longer wavelengths (>600nm) penetrate deeper but need more energy to cause melanosome damage. A longer pulse duration delivers slower laser light resulting in mitigated epidermal heating. Consequently, epidermal cooling is more effective thereby reducing rapid heating and damage to the melanosomes. The calculated TRT of melanosomes is less than 1 microsecond corresponding to 250 to 1000 nanoseconds. As previously discussed, a pulse duration less than the TRT will decrease risk of damage to the melanosome.

Hair Removal

With the advent of lasers with longer wavelengths, longer pulse durations, and efficient cooling devices, all skin types can be treated with lasers for hair removal with reduced risk of adverse outcomes. Caution must be taken when performing laser treatments in patients with a tan, in fact, it should be avoided to prevent adverse effects as seen in Figure 5. As the provider, it is important to ensure that the handpiece is perpendicular to the skin surface and to avoid overlapping during pulses. It is also essential to confirm the cooling device to functioning properly before starting the procedure. We believe two wavelengths are generally appropriate for use in dark Latino skin, which include the Diode laser 810nm at low fluence and high repetition rate "in motion" (up to phototypes V) and Nd:YAG 1064nm (up to phototypes VI).

FIGURE 5. Post inflammatory hyperpigmentation after using Nd:YAG on recently tanned skin.



Melasma

Melasma treatment is one of the most difficult and frustrating conditions to manage and unfortunately a very common condition among Latinos. The origin of hyperpigmentation can be epidermal, dermal, junctional, or a combination. A wood's lamp can be used to determine the depth. Given melasma has a hormonal component and is essentially caused by ultraviolet light exposure, it is expected to almost always return after treating. It is important to counsel patients that treatment does not cure their melasma. We generally turn to a laser when the case is resistant to more conservative treatment, which includes topical skin lighteners including Kligman's formula, and/or light peels, or oral tranexamic acid. In general lasers have revolutionized the treatment of dermatological disorders but its place in the management of melasma and post inflammatory hyperpigmentation (PIH) is still controversial. The QS-Nd:YAG is the most widely used laser for the treatment of melasma. Our parameter recommendation includes fluence less than 5 Joules/cm2, spot size 6 mm, and frequency of 10 Hz. Heat can exacerbate melasma, therefore a single pass should be performed on each area to be treated prior to additional passes. Specifically, up to three passes are performed, allowing the tissue to properly cool between passes. The toning procedure will utilize low fluence with a large spot size. The number of treatment sessions varies from 5 to 10 at 1-week intervals. Rebound hyperpigmentation could be due to the multiple sub threshold exposures that can stimulate melanogenesis in some areas, and/or inflammation with secondary PIH. Monthly or quarterly maintenance is performed to maintain results. The use of pulsed dye laser (PDL) for the treatment of melasma is based on the theory that skin vascularization plays an important role in the pathogenesis of melasma. Particularly, it is known that melanocytes express vascular endothelial growth factor receptors, which cause the telangiectasias. Table 2 outlines the lasers we use to treat melasma. Figure 6 depicts a Latina patient treated with two sessions with the Picosecond 1064nm laser two weeks apart.

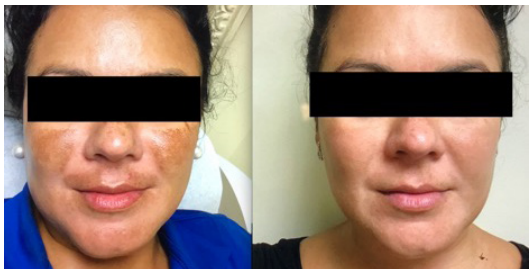
Chromophore: Water

Water is the targeted chromophore in most resurfacing procedures. Ablative resurfacing creates a controlled partial-thickness damage down to the dermis, therefore use in phototypes V and VI is usually not indicated due to the risk of dyspigmentation

TABLE 2.

Laser and Light Devices Used in Practice to Treat Melasma
IPL 570-580nm • Low fluence, internal and external cooling, long pulse duration (6-8 j/cm2-15ms)
Fraxel 1550nm • Low fluence, few passes, more sessions • The density used varies from 2000 to 2500 MTZ/cm2 and energy levels 6 to 10mJ/ms. The treatment sessions vary from 2 to 6 at an interval of 1–4 weeks
Ablative pixelated Er:YAG 2940nm
Affirm MPX Dual Fractional Laser 1320/1440nm
Picosecond 1064nm Laser

FIGURE 6. Before and after image of a Latina woman showing improvement of her melasma after two sessions using the Picosecond 1064nm laser two weeks apart.



and scarring. The emergence of the nonablative resurfacing lasers has allowed people of darker skin tones an opportunity to treat pigmented skin condition, rhytides, as well as skin texture, with less risk of side effects. Fractional or pixelated resurfacing is another safe nonablative device that can be used for resurfacing in people with skin of color. We outline the lasers we use in our practice for resurfacing in Table 3.

Skin Rejuvenation

Traditionally, ablative lasers, such as the carbon dioxide (CO2) and Erbium:YAG have been the gold standard in rejuvenation but can cause several unwanted side effects in Latino skin. Specifically, it has been described to cause hyperpigmentation in 31% of all skin types increasing to 50% in type III Fitzpatrick skin phototypes.[5] In addition, there can be a delayed onset of hypopigmentation and transient erythema lasting months. The increase in adverse effects when resurfacing patients with skin of color makes pre-treatment and patient selection important in order to reduce these outcomes. Some more appropriate treatment alternatives for darker skin types include non-ablative infrared, micro needling, and radiofrequency devices.

TABLE 3.

Resurfacing Lasers That Target Water	
Fractional	Fractionated 1550nm erbium doped fiber laser
Nonablative	Nd:YAG 1064nm
Ablative	CO2 10,600nm

The newer category of micro-ablative resurfacing lasers (fractional CO2, fractional Erbium, and the 2790nm Yttrium Scandium Gallium Garnet [YSSG]), offers a safer modality with which to treat Fitzpatrick skin type IV and above. Compared to the older generation resurfacing lasers the micro-ablative lasers minimize the amount and duration of erythema and edema, which can last just three to four days. A recent retrospective study of Chinese patients treated with the 1,550nm erbium-doped fractional laser (Fraxel 1550, Solta Medical) found that using fewer passes per treatment but increasing the total number of treatments was associated with a lower risk of post-inflammatory hyperpigmentation without compromising efficacy.[6]

Management of Complications

One of the most common malpractice lawsuits is laser complications. It is important to ensure that all laser practitioners are certified and that providers have reviewed laser laws their state. Pre- and post-treatment photos are essential. It is also important to document settings and informed consent. If an issue arises, the provider should make themselves available 24/7 and prepare for a lot of hand holding. The best treatment for complications is prevention. Table 4 outlines acute and chronic complication management that we practice in our office.

CONCLUSION

The use of lasers in people with skin of color requires an understanding of laser physics and laser tissue interactions. It is very important to be familiar with the laser device as not all energy-based devices work similarly. The Latino population encompasses the range of all phototypes and therefore one rule cannot apply to all Latinos. Proper selection of device, wave-

TABLE 4.

Complication	Management
Acute	Superficial erosions/bullae • Clean with a mild soap • Silver sulfadiazine Infectious (bacterial and viral) • Treat accordingly with antibacterial or antivirals erythema/pruritus • Control inflammation with a short pulse of a potent topical corticosteroid • Intralesional 5FU/Kenalog
Chronic	Pigmentation • Hyperpigmentation • Hydroquinone 8-10% cream • Lasers: IPL or qsNd:YAG • Sunscreen, SPF60 • Hypopigmentation • Moisturization • Latisse • Sun exposure • Scarring • Short pulses of potent topical steroid, Intralesional 5FU/Kenalog • Fractionated Er:YAG or CO2 • PDL and IPL at 515nm

length, and treatment parameters are essential for safety and efficacy. In addition, pre-and post-treatment protocols are pivotal in the prevention of dyspigmentation and scarring.

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