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STRATEGIES TO OPTIMIZE OUTCOMES AND PREVENT COMPLICATIONS WITH LASERS

Introduction

The world of device-based treatments of the skin is unregulated, with minimal enforcement of laser operator training and credentials, combined with an often purposeful *"gray zone"* in terms of qualifications communicated to patients.[1] Dermatologists and the staff they directly supervise are at an advantage when it comes to appropriately diagnosing conditions of the skin, as well as delivering effective and safe treatments. Light-and laser-based devices are one of the many tools in the dermatologist's armamentarium and optimizing their use has the potential to provide superior outcomes for patients. We share herein pearls from nearly ten years of experience in the field to refine your laser dermatology practice.

1. Treat to effective biological endpoints with your vascular- and pigment-targeting lasers

Lasers can target various chromophores within the skin, such as DNA, hemoglobin, melanin, water, sebum or fat. Hemoglobin and melanin, in particular, can be effectively targeted while minimizing risks of treatment by treating to biological endpoint.[2]

When targeting hemoglobin with a vascular laser, endpoints can be non-purpuric or purpuric.

Non-purpuric endpoints include the persistent contraction of a telangiectasia, temporary blanching (edema) to treat background erythema or the persistent contraction of a vein (sometimes accompanied by a faint pop). To shorten the "social recovery," purpura is often considered undesirable and can in certain circumstances be considered a side effect. However, in many instances, such as treating cherry angiomas or treating a dark capillary malformation, it can be the desired biological endpoint (**Figure 1**).

When targeting melanin with a nanosecond or picosecond range pigment-targeting laser, the preferred biological endpoint is an immediate whitening reaction (**Figure 2**). Depending on the degree of contrast of the lesion and on the device, this may be quite stark or very faint. When using a millisecond range pigment-targeting laser to perform laser hair removal, the ideal biological endpoint is perifollicular erythema/edema.

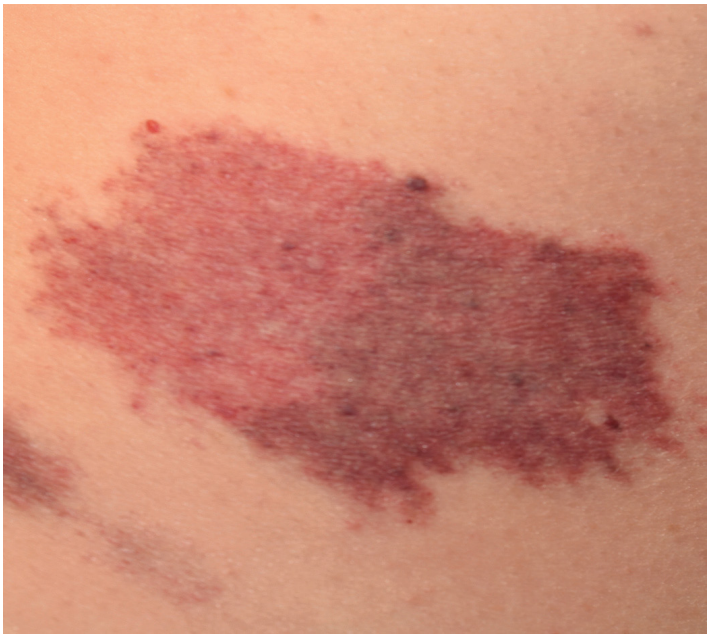

Figure 1. *A purpuric endpoint is observed on the right side of this capillary malformation. Treatment was interrupted to show the contrast with the untreated lesion (left); photo courtesy of Vincent Richer, MD.*

Figure 2. *Immediate whitening reaction as a favourable biological endpoint following Q-switched alexandrite laser exposure of a solar lentigo; photo courtesy of Vincent Richer, MD.*

2. Be aware of biological endpoints that may signal a potential complication

Laser operators would do well to use conservative fluences initially and exercise patience to monitor the skin for the desired biological endpoint. Special attention should be given to the development of undesirable biological endpoints that may suggest excess tissue damage.[3] In the context of vascular laser treatment, gunmetal gray discoloration or persistent pallor should prompt the laser operator to halt treatment and stop or scale back treatment. When using a nanosecond or picosecond range melanin-targeting laser, excess fluence can cause epidermal damage beyond the immediate whitening reaction. This may be associated with epidermolysis which is also a sign to deliver more conservative treatment fluences.

3. Prevent and manage pain and anxiety pro-actively

Considering that exposure to most laser beams is associated with some pain, pain management is a critical element of treatment planning and delivery. Many laser devices are equipped with a cooling mechanism such as contact cooling, forced cool air or cryogen spray, both for pain control and to limit epidermal damage from laser exposure. These typically provide partial pain control. When treating small areas such as the face, compounded lidocaine up to 30% will provide more pain relief than commercially available topical anesthetic preparations. Occlusion with cling wrap is a simple and inexpensive way to potentiate the process and can be particularly useful over larger, flat surfaces (i.e. scalp, dorsal hands). There is some controversy regarding the use of topical anesthetics in the context of IPL or vascular laser treatment. Astute clinicians have noticed that topical anesthetics have a degree of vasoactivity, leaving the skin more blanched or erythematous after topical anesthetics have been used. This has led to the concern that topical anesthetics may mask the hemoglobin chromophore, rendering treatment less effective. A recent review[4] highlighted that other vasoconstrictors (such as oxymetazoline) may increase the effectiveness of vascular lasers, and that the limited published evidence on pulsed-dye laser comparing topical anesthesia to vehicle or no anesthesia does not support a difference. This suggests there is insufficient evidence to recommend against the use of topical anesthetics in the context of vascular laser treatments.

For more aggressive procedures such as fractional ablative resurfacing, nerve blocks and local anesthesia can be used. Patient anxiety should be managed in a case-by-case basis. Nitrous oxide is increasingly being used in cosmetic dermatology clinics. If benzodiazepines or opioid derivative drugs are used for pain control, it should be confirmed that patients can be driven home by a relative or other individual.

4. Ensure appropriate eye protection for both the patient and the laser operator

Laser eye injury is arguably one of the most devastating potential complications of laser surgery. A recent review[5] revealed that the majority of eye injuries occurred in the setting of laser removal of facial hair and that in 73% of cases, improper eye protection was used. Operators are advised to consider the optical density on the goggle they are donning to ensure they are protected for the wavelengths used. Special attention is required in rooms where multiple devices (and consequently goggles providing varying levels of protection) are present. For patients, "black-out" anodized metal goggles are recommended when treating the face. Alternatively, disposable laser-safe stickers have been designed to grant appropriate protection. If treatment over the orbit is required (upper eyelid, lower eyelid not overlying bone), a well-lubricated metal corneal shield should be placed after use of an anesthetic drop prior to any treatment (**Figure 3**).

Figure 3. *Disposable laser-safe stickers (left) and Cox II metal corneal shields (right); photo courtesy of Vincent Richer, MD.*

5. Do not delay treatment of acne scars until at least six months following isotretinoin therapy

In 2017 a consensus paper[6] was published highlighting that there is insufficient evidence to delay most acne scar treatments (apart from aggressive dermabrasion and full-field ablative resurfacing), effectively challenging the accepted protocol that one should wait at least six months after a course of isotretinoin was completed before initiating acne scar treatment. This has allowed more prompt treatment of acne scarring in our patients with severe acne requiring isotretinoin treatment. In addition, several articles have been published exploring the use of laser devices during treatment with isotretinoin, for example to treat post-inflammatory erythema/red scars (**Figure 4**) or to begin resurfacing as soon as inflammatory lesions were cleared. This is also relevant to our patients on low-dose, suppressive isotretinoin treatment who are seeking to improve their complexion with laser treatments.

Figure 4. *Post-inflammatory erythema from acne that was cleared with isotretinoin was treated with vascular laser to hasten clinical improvement; photo courtesy of Vincent Richer, MD.*

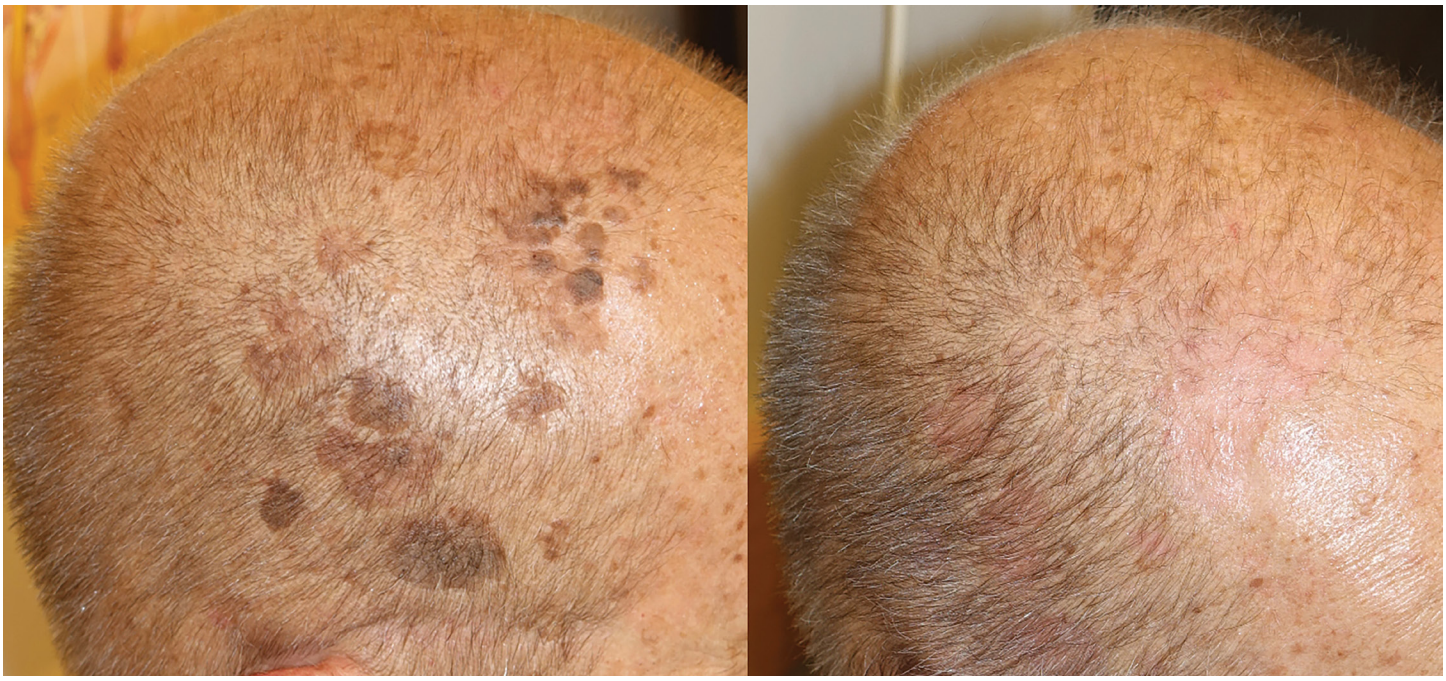

Figure 5. *Seborrheic keratoses of the scalp treated with CO2 laser resurfacing. Notice hair growth at the site of treatment as seborrheic keratosis is a superficial lesion that does not need deep ablation to remove, as well as post-inflammatory erythema from the procedure; photo courtesy of Vincent Richer, MD.*

Figure 6. *Treatment of dermatosis papulosa nigra with long-pulse KTP laser. Notice the response was not as effective for solar lentigines present within the treatment area; photo courtesy of Vincent Richer, MD.*

6. Consider laser therapy when treating benign epidermal lesions

It is common for clinicians to initially consider cryotherapy, electrocautery or traditional shave excision to remove benign epidermal lesions;however, sometimes the precision of a laser can make a difference. There is a paucity of clinical data confirming the superior nature of ablative lasers when treating benign epidermal lesions. In the treatment of seborrheic keratoses, erbium YAG laser treatment led to longer post-inflammatory erythema, but less post-inflammatory pigment alteration when compared to cryotherapy (**Figure 5**).[7]

There is room for creativity in the use of lasers to treat benign epidermal lesions. For instance, we have reported on the efficacy and safety of pull-stacking the long-pulse KTP laser for treatment of dermatosis papulosa nigra (**Figure 6**).[8]

Figure 7. *Medical treatment of acne followed by six sessions of combination subcision + 1550 nm non-ablative fractional resurfacing; photo courtesy of Vincent Richer, MD.*

7. Discuss laser treatments with your medical dermatology patients when it is relevant to their condition

Many of our medical patients can benefit from laser treatments, and they may seek treatment outside of your office with less qualified providers. Vascular lasers can help our patients with vascular rosacea, post-inflammatory erythema from acne, red scars, and capillary malformations. Millisecond range pigment-targeting lasers can help our patients with hirsutism, whereas nanosecond and picosecond range pigment-targeting lasers can help our patients with solar lentigines and tattoos, for example. Resurfacing can treat multiple aspects of chronic sun damage, including actinic keratoses. A recent small retrospective cohort study has shown the development of fewer keratinocyte carcinomas in patients undergoing non-ablative fractional resurfacing.[9] Despite this, in general, ablative resurfacing is considered to have superior efficacy in clearing actinic keratoses.[10]

8. Administer combination or serial treatments, even low-tech ones

While in many cases a single device can be sufficient to treat a focal issue, full-face treatments often require treating multiple conditions and may require more than one treatment modality. Lasers can be combined in the same session – however, clinicians should also consider low-tech tools such as cryotherapy, electrocautery, chemical peels, and subcision.

This is a partial list of my preferred combination treatments:

- Focal vascular or pigment-targeting laser followed by full-face IPL
- Focal vascular laser for telangiectasias + full-face 1927 nm laser fractional resurfacing for solar lentigines, actinic keratoses and textural changes
- Pigment-targeting laser for solar lentigines and light cryotherapy for thin seborrheic keratoses
- TCA CROSS + cannula subcision + 1550 nm laser fractional resurfacing or TCA CROSS + cannula subcision + CO2 laser fractional resurfacing for acne scars to target different morphologies (icepick, boxcar, rolling) (**Figure 7**).

This is a partial list of my preferred sequential treatments:

- CO_2 laser ablation of benign epidermal lesions (such as sebaceous hyperplasias) followed by vascular laser for post-inflammatory erythema and erythema/telangiectasias
- Hyaluronic acid dermal fillers to rapidly improve acne scars, followed by a series of non-ablative resurfacing laser treatments for long-term correction

9. Establish appropriate patient expectations

Certain skin conditions can be improved dramatically with one or several treatments, while others require multiple treatments or respond unpredictably. Since as dermatologists we can establish a proper diagnosis, we are in an excellent position to discuss the expected response to treatment with our patients and to let them decide if they see value in initiating a treatment plan.

For example, the vast majority of spider angiomas and venous lakes respond to one treatment session or may require only a subsequent touch-up treatment, which represents great value for our patients. Non-ablative fractional resurfacing of rolling and boxcar acne scars, for example, requires several sessions to provide noticeable improvement, while icepick scars do not respond well to this treatment modality. Some conditions, such as melasma, are usually not well managed with monotherapy using lasers.

10. Consider performing spot-tests

Laser test spots refer to the treatment of a small, focal area involved by the skin condition. They can serve numerous purposes:

- Test the clinical response in a condition that is either difficult to treat or in which the clinical response is unknown/unpredictable
- Test recovery or side effect development in a patient who may be at risk of a complication (for instance, due to their skin type or previous experience with other providers/devices)
- Establishment of a therapeutic window, by testing various settings (fluence, pulse duration, spot size) of a single device
- Establishment of a preferred wavelength/device for treatment, by using various devices over adjacent areas (**Figure 8**).

Although time-consuming, spot-tests can provide valuable information that is customized to the patient's skin. A cautious approach is often appreciated by patients when the scenario warrants it, for instance if they have had a negative experience with another provider/device but are still motivated to treat their skin condition.

Conclusion

Dermatologists are in a privileged position to provide their patients with the best that laser devices can provide. By treating to biological endpoint; anticipating patient pain/anxiety; ensuring appropriate eye protection; not rejecting patients with recent isotretinoin treatment; exposing medical dermatology patients to laser treatment options; performing combination treatments; setting expectations; and performing spot-tests when relevant, we can maximize treatment outcomes while minimizing complications for our patients.

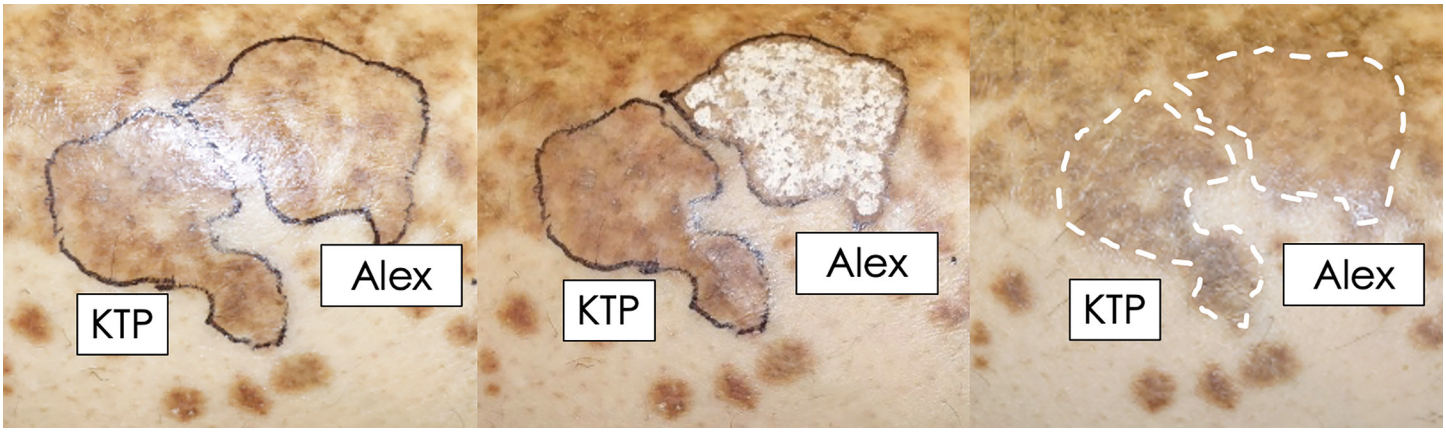

Figure 8. *Spot-test sequence representing the evaluation of two wavelengths (KTP 532 nm and QS Alexandrite) for the treatment of hemosiderin staining from pigmented purpura. In the first panel, the treatment areas are outlined. In the second panel, immediate whitening reaction is observed as a biological endpoint for the alexandrite laser, while only erythema is observed with the KTP laser. On the third panel, which represents six-week follow-up, there is lightening of the lesional area where the alexandrite laser was used, and no change in the KTP laser area; photo courtesy of Vincent Richer, MD*

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Financial Disclosures

None.

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