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ANSWERING 10 BURNING QUESTIONS ON FRACTIONAL RESURFACING

Introduction

Skin resurfacing refers to the therapeutic act of delivering a controlled injury to the skin to improve surface characteristics such as pigment, texture and rhytides¹. Consequently, many dermatology patients may benefit from resurfacing, whether they have actinic damage, solar lentigines, acne scarring or elastosis. Although there are many resurfacing modalities beyond lasers (i.e., microneedling, chemical peels, mechanical dermabrasion, microneedling-radiofrequency, etc.), this article will primarily address fractional laser resurfacing. Reviewing fully ablative laser resurfacing is beyond the scope of this article, although the use of fully ablative lasers for ablation of benign skin lesions will be discussed.

What are the critical concepts behind fractional laser resurfacing?

Resurfacing lasers target water as a skin chromophore. Photons with wavelengths beyond ~1200 nm have high affinity for water and do not compete significantly with hemoglobin and melanin.

Photons with wavelengths beyond ~2500 nm have such high affinity for water that their energy is fully absorbed and they vaporize tissues: this is known as ablation. Consequently, lasers with longer wavelengths such as the Er:YAG (2940 nm) and the CO₂ laser (10 600 nm) are ablative, while shorter wavelength such as the Er:Glass (1550 nm) and thulium fiber (1927 nm) are nonablative.

Fractional delivery has revolutionized the field of laser resurfacing by dialing down the expected recovery time and risks of ablative laser treatments². Rather than delivering laser energy to the full treatment field, a "fraction" of the area is treated with microscopic beams covering a desired percentage of the skin. This allows for untreated tissue within the treatment area to contribute to speeding up recovery. Both nonablative and ablative lasers can be delivered via fractional treatment.

Can resurfacing treatments be titrated – and how?

Unlike with hemoglobin and melanin-targeting lasers, increasing the fluence of fractional water-targeting

lasers will increase the depth of optical penetration of the laser. This can be done to titrate treatment to the depth of the pathology being treated. The “treatment level” or “density” of treatment has the most significant impact on energy delivery and subsequent recovery/risks, but also on outcomes. For instance, a 60% density treatment is much more aggressive than a 30% density treatment. In general, laser resurfacing is a “no pain, no gain” situation: the more energy that is delivered to the skin, the more improvement per treatment can be observed – but also the longer the recovery and the higher the risk of side effects (i.e., infection, post inflammatory pigment alteration, scarring, etc.). Fractional nonablative resurfacing treatments, which are generally less “aggressive” than fractional ablative resurfacing treatments at equal densities, will require more treatment sessions to provide desired outcomes. If a condition requires multiple treatment sessions, for instance treating acne scars with the nonablative Er:Glass (1550 nm) laser, density can be slightly increased at subsequent treatments if patients experience a favorable recovery with an absence of complications.

Does resurfacing treat actinic damage?

Because actinic keratosis and cheilitis represent dysplastic changes in the epidermis, it stands to reason that superficial resurfacing could treat actinic damage. A recent Canadian review³ highlighted that laser resurfacing as a field treatment may be comparable to 5-fluorouracil or 30% trichloroacetic acid peel treatment, with fully ablative resurfacing being more effective than fractional resurfacing. The 1927 nm thulium laser is a nonablative fractional laser with high water affinity leading to superficial optical penetration to the epidermis/superficial dermis⁴ (**Figure 1**). In the literature and in the author’s practice, it is effective at reducing actinic keratoses while simultaneously improving solar lentigines, texture, fine rhytides and elastosis. Because of the privileged healing properties of the vermilion lip, CO₂ laser vermilionectomy is an attractive option to treat actinic cheilitis (**Figure 2**).

Are there advantages to using ablative lasers over other destructive modalities for ablation of benign skin lesions?

Most laser devices with an ablative wavelength will carry a “surgical” handpiece that allows for full-beam laser exposure over a defined spot size thereby allowing for lesion ablation. There is a paucity of scientific literature validating that this leads to better

cosmetic outcomes compared with other destructive modalities such as electrosurgery, however it is the author’s experience that it provides very precise control and finesse over the procedure and should be considered when treating benign skin lesions at cosmetically sensitive sites (**Figure 3**). As with all laser procedures, a metal corneal shield is recommended when treating the skin overlying the orbit, such as when ablating xanthelasma (**Figure 4**).

How do you choose between nonablative vs. ablative fractional laser ?

Since resurfacing is a “no pain, no gain” phenomenon: the condition treated, desired improvement, desired timeline, capacity for recovery and understanding of risks must be matched with the right treatment. Patients undergoing fractional nonablative resurfacing should expect that several treatments may be necessary for significant improvement. Though post inflammatory pigment alteration is possible, the risk is lesser than with fractional ablative resurfacing. Patients who cannot accommodate prolonged recovery or significant aftercare are best suited for nonablative treatment. Rolling acne scars carry the best prognosis for nonablative laser resurfacing⁵ (**Figure 5**), followed by boxcar scars. Icepick scars may require punch excision, trichloroacetic acid (TCA) CROSS or ablative laser treatment⁵ (**Figure 6**). Patients who undergo fractional ablative resurfacing will experience significant clinical improvements with one or a few treatments, with improvement continuing a few months after the procedure; however, they will experience a prolonged recovery with significant aftercare (**Figure 7**). Perioral rhytides, icepick acne scars and acne scars localized to the nose or forehead will often require more treatment modalities and more aggressive settings to improve.

How can we make resurfacing treatments more comfortable?

Topical anesthetics are routinely used ahead of fractional resurfacing procedures. When small surfaces are treated such as the face, the author favors high-concentration compounded topical anesthetics such as 23% lidocaine + 7% tetracaine or 30% lidocaine over commercially available topical anesthetics. Patients will incubate for one hour prior to the procedure, sometimes with occlusion. For fractional ablative treatments, relevant blocks (i.e., supraorbital, infraorbital, mental) performed 15 minutes before the procedure enhance patient comfort. The intraoral administration of the

infraorbital and mental blocks is particularly comfortable for patients. Lastly, lateral aspects of the forehead and cheeks as well as the hairline may also require local infiltration. Laser surgeons would do well to keep an eye on the total dose of lidocaine injected during the procedure to avoid lidocaine toxicity.

What precautions must patients undergoing fractional ablative resurfacing follow?

During the initial consultation, patients that have been identified as carriers of the HSV virus should be prescribed HSV prophylaxis in the form of oral valacyclovir, which is to be initiated on the day of the procedure. Infection prevention is critical, and as such patients will be preparing dilute vinegar (1 part vinegar to 9 parts water) soaks to the skin every 3 hours until reepithelialization occurs, followed by application of a thick ointment to assist in skin barrier formation. The avoidance of direct sunlight is recommended to minimize risks of dyspigmentation. A disposable paper pillowcase is provided by our clinic as oozing and pinpoint bleeding is expected to occur over the first night. Close email and phone contact with the office, with photo updates and answering of questions, should be organized to catch any complications quickly.

What treatment combinations are useful with resurfacing treatments?

Depending on indication and patient objectives, lasers (i.e. vascular, Q-switched, picosecond, etc.) are routinely performed in the same treatment session prior to resurfacing. But laser surgeons should not discard “low tech” treatments that can have an additive effect to resurfacing. Cryotherapy or electrosurgery can be performed to focal actinic keratoses or seborrheic keratoses prior to superficial resurfacing. Subcision of rolling scars or TCA CROSS of ice-pick scars can be performed prior to resurfacing. In general, down time is not entirely additive and clinicians can take advantage of the recovery time allotted for resurfacing to provide an enhanced result within the same treatment episode.

When is it best to avoid laser resurfacing?

In general, patients that are at risk of poor wound healing due to underlying medical conditions make poor candidates for resurfacing. In practice, patients who are very pain sensitive, who cannot accommodate recovery time or who are ill-prepared to follow aftercare directions are not ideal for resurfacing. The patient’s diagnosis is also a critical consideration to predict potential improvement from

resurfacing. For example, in the author’s practice, melasma is primarily treated medically with topicals and oral tranexamic acid. Occasionally, other treatments will be better suited to the patient’s timeline. Hyaluronic acid fillers may be used to provide quick improvements in acne scarring (**Figure 8**) or superficial rhytides (**Figure 9**) if patients desire fast improvement for a special event or cannot accommodate the downtime associated with resurfacing.

What is laser-assisted drug delivery?

Laser-assisted drug delivery is the topical application of medication immediately following low-density fractional ablative resurfacing, resulting in both the therapeutic effects of resurfacing and in the even dispersion of the topical medication in the skin through ablation channels. It has been most studied for the treatment of hypertrophic scars to deliver triamcinolone acetonide, 5-fluorouracil and botulinum toxin among others. A global consensus paper on laser-assisted drug delivery was recently published⁶. It is a promising treatment modality that has the potential to help with difficult scenarios, including in the case of refractory red tattoo allergy (**Figure 10**) improved by fractional CO₂ laser (helped with extrusion of red tattoo pigment) followed by application of triamcinolone acetonide and 5-fluorouracil (to suppress the inflammatory reaction).

Conclusion

Fractional laser resurfacing is a useful tool that is a natural extension of the expertise of dermatologists. Being a “no pain, no gain” modality, the type of device (nonablative vs. ablative) and treatment settings (fluence, density) must be chosen after careful consideration of the condition treated, the patient’s skin type, their timeline for outcomes and their ability to handle recovery (“downtime”). The finesse of matching the right patient with the right treatment is part of the art of medicine. These devices can treat actinic damage, can be used in surgical mode for precise benign lesion ablation and can provide laser-assisted drug delivery. Pain control during the procedure and patient preparation/follow-up are critical for a positive experience. Dermatologists have several tools in their therapeutic toolbox: these can be combined with fractional resurfacing or may outperform resurfacing depending on the patient’s situation.



Figure 1: Actinic keratoses of the forehead treated with one session of thulium fiber 1927 nm resurfacing; image courtesy of Vincent Richer, MD



Figure 2: Actinic cheilitis treated with CO₂ laser vermillionectomy in a patient with previous history of in situ squamous cell carcinoma of the lip managed surgically; image courtesy of Vincent Richer, MD



Figure 3: Intradermal melanocytic nevus after superficial shave excision followed by CO₂ laser ablation of the base; image courtesy of Vincent Richer, MD



Figure 4: Xanthelasma treated with CO₂ laser ablation. A metal corneal shield was placed during the procedure; image courtesy of Vincent Richer, MD



Figure 5: Rolling scars of the temple improved after four sessions of fractional ablative resurfacing (Er:Glass 1550 nm) with increasing energy densities; image courtesy of Vincent Richer, MD



Figure 6: Severe acne scarring including several ice-pick scars treated with a multimodal plan including fractional ablative resurfacing; image courtesy of Vincent Richer, MD

Day #1 - no vinegar soaks.
lots of oozing & blood.

Day #2 - vinegar soaks every 3 hours.
still oozing/bleeding. Applied thick aquaphor.

Day #3 - vinegar soaks cont'd.
Started itching a bit. Thick aquaphor.



Day #4 → vinegar soaks cont'd.
med-thick aquaphor.



Day #5 - 2x vinegar soaks.
less aquaphor, stings a bit.



Day #6 (today) - stings/itches a lot.
No peeling yet, scabs are soft.



Figure 7: Patient photo diary following her recovery from fractional ablative resurfacing to the forehead and temples; image courtesy of Vincent Richer, MD



Figure 8: Mild rolling scars improved partially by injection of a low G' filler with cohesive polydensified matrix; image courtesy of Vincent Richer, MD



Figure 9: Perioral "smoker's lines" improved partially by injection of a low G' filler with cohesive polydensified matrix; image courtesy of Vincent Richer, MD

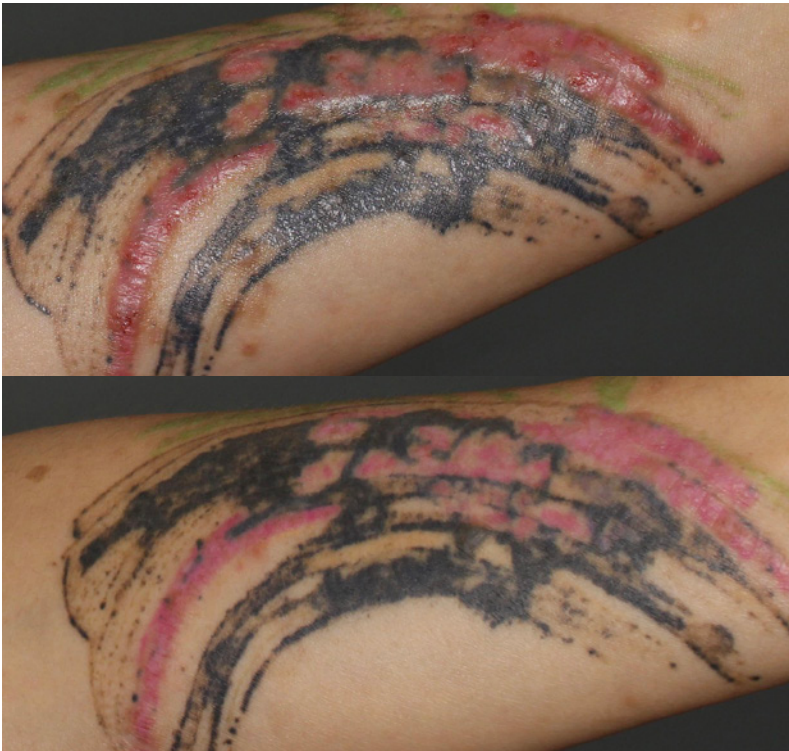


Figure 10: Refractory red tattoo hypersensitivity treated with laser-assisted drug delivery of triamcinolone acetonide and 5-fluorouracil; image courtesy of Vincent Richer, MD

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