

Complications of Facial Resurfacing

Aggressive resurfacing remains the biggest offender in terms of post-treatment complications, especially erythema and hyperpigmentation

BY JOSEPH NIAMTU, III, D.M.D.

A paradigm shift has occurred in cosmetic surgery, dermatology and other aesthetic specialties. We went from the resurfacing options of dermabrasion and chemical peeling to the “new” technology of laser skin resurfacing (LSR). Laser technology hit cosmetic facial surgery like a hydrogen bomb. The advances in controlling the pulse width of the laser beam as well as understanding the concept of thermal relaxation time led to a safe and effective high-tech means of facial rejuvenation. As is predictable with most new technologies, the procedure was pushed to the limits by different specialties, resulting in great results but also complications and lawsuits. Again, predictably for new technology, techniques fell into disfavor with many practitioners but continue to be mainstream in the practices of other surgeons, including this author.

The prolonged healing, possible complications and/or sequelae and the intense post-operative care required made aggressive CO₂ laser resurfacing less palatable for patients and surgeons. In addition, the media, corporate, and consumer push for less invasive resurfacing techniques kept CO₂ LSR on the back burner of many practices. I believe there has been a resurgence of CO₂ LSR due to the poor performance and results associated with some of the “minimally invasive” resurfacing techniques. In most busy cosmetic practices, a single skin rejuvenation procedure is not the answer, but rather the diversity of patient population requires multiple options. It is not uncommon for contemporary cosmetic surgeons to use



Figure 1. This image shows a patient with significant post-laser hyperpigmentation at 30 days and 14 days later after treatment with creams.

(Right) Figure 2. Figure 2A shows areas of pulse stacking (over treatment) from multiple pass CO₂. Figure 2B shows a latic pattern from IPL hair removal, with a blistered area of over treatment.

TABLE 1

The depth of skin injury related to reepithelialization time.

Level of Skin Injury	Healing Time
Stratum corneum exfoliation	2-3 days
Basal layer exfoliation	4-6 days
Papillary dermis	7-8 days
Mid-dermis	10-12 days

TABLE 2

Complication rates from 500 laser resurfacing patients.

Complication	Rate
Erythema	100%
Hyperpigmentation	37%
Acne flare	15%
Milia	11%
Contact dermatitis	10%
Herpes simplex infection	74%
Hypopigmentation	1%
Hypertrophic scarring	0%
Ectropion	0%

CO₂ LSR, chemical peeling (ranging from superficial to deeper levels), microdermabrasion, fractionated laser resurfacing, radiofrequency tightening technology, and intense pulsed light (IPL). We are all to some extent “bartenders” offering a panoply of options customizable to fit the specific patient in terms of skin type, desired result, recovery, and budget. To stay contemporary, the progressive practitioner must embrace new technology to stay on the cutting edge, but only use what works, to remain accountable.

Regardless of the technique of damaging the skin, the skin reacts basically the same way in its response to the insult. It is possible to undertreat with an ablative CO₂ laser to minimally damage the skin or overtreat with a less invasive technology (extreme multiple high pressure micro dermabrasion). Having said this, the basis of complications has a lot to do with the level of damage to the skin. Although we can sometimes undertreat and other times overtreat the skin, one can judge the actual

amount of skin damage by the length of time it takes to re-epithelialize. A superficial epidermal treatment will heal in about 48 hours, a full epidermal injury will take four to six days to epithelialize, a papillary dermal injury will take about seven to eight days to heal, and a reticular dermal injury takes 10-12 days to reepithelialize (Table 1). Resurfacing wounds that take longer than two weeks to heal will frequently cause scarring as they are at the level of the adnexa and considered full thickness.

Almost any complication can occur with almost any treatment, and it stands to reason that the more ag-

gressive the treatment, the greater the chance of complications. I should also point out that many conditions that patients see as complications are actually sequellae.

In their landmark article, Alster and Nanni reviewed 500 cases of laser skin resurfacing and categorized their complications, as shown in table 2. Although table 2 illustrates aggressive, full-face CO₂ laser resurfacing, any or all of these problems can and do occur with other common resurfacing modalities, including IPL and other “non-ablative” procedures.

COMPLICATIONS AND SPECIFIC MODALITIES

Aggressive resurfacing (laser and peel) remains the biggest offender in terms of post-treatment complications, with CO₂ laser leading the way. I personally put the Er:YAG laser in the in same category as the CO₂ laser assuming similar treatment depths. Persistent erythema is always a concern



with aggressive CO₂ laser treatment. It is related to the depth of injury, the post-op care, and most importantly, to patient skin type. My experience is that 99% of patients treated aggressively with the CO₂ laser will reepithelialize in about 10 days and begin applying make up. The erythema usually resolves between three weeks and three months, but can persist for longer in the lighter Fitzpatrick skin types. In addition, in the Fitzpatrick 1 and 2 skin types with ectatic vessels and/or rosacea, erythema can persist for many months. Other patients with tendencies to easily blush from vasodilatation are predisposed to ex-

tended erythema. If a patient becomes easily flushed with such things as valsalva, alcohol or caffeine consumption, or emotional stimuli, they too, can experience extended erythema. Some practitioners will treat extended erythema with vitamin C preparations or azelaic acid 15%. Bacterial, monilial, or herpetic infections can also extend erythema and sometimes go undiagnosed as the causative agent.

HYPERPIGMENTATION

In my view, hyperpigmentation is so common it should be characterized as a sequella rather than a complication. It appears that about one third of patients undergoing aggressive resurfacing (laser or peel) will experience post-inflammatory hyperpigmentation. The use of pre-treatment skin conditioning is controversial, but I always perform this with chemical peel patients and rarely do so with laser resurfacing patients. Obviously, darker skin types have

significantly increased incidence of hyperpigmentation. In addition to the inflammation secondary to the resurfacing procedure, inflammation can result from sun exposure and overhead lights, automobile defrost systems, hair dryer irritation, and self-medication of the inflammation resulting from laser and chemical peels. Post resurfacing melanocytes can be very finicky! The hyperpigmentation usually manifests as a blotchy tan that is generalized over the treated area (Figure 1). This classically occurs at about 30 days and usually responds well to treatment with Retin-A and hydroquinone 4%. In

stubborn cases, the pigmentation can actually worsen from the irritation of the Retin-A or bleaching agent. These patients may respond by using topical and systemic anti inflammatory steroid treatment. I advise all patients who undergo deep laser or medium-depth chemical peels that they are going to experience hyperpigmentation. The 30% that do expect it, and the 70% that don't think I am a hero. I believe my incidence of hyperpigmentation is somewhat higher as I practice in the sunny south.

COVERAGE IRREGULARITIES

The application of the acid during chemical peeling is pretty homogenous and areas of under- or overtreatment are rare. The same can be said about multi-pass laser resurfacing because two or three laser passes manage to cover the face uniformly without skipping areas. With the advent of more conservative laser treatments, a single laser pass is frequently employed. Regardless of scanner accuracy or operator ability, overlapping (inadvertent pulse stacking) or “underlapping” (missing a small area) can leave lattice or grid patterns on the face (Figure 2A). If severe, these can be permanent but most always resolve with post laser Retin-A and hydroquinone.

These coverage irregularities are not only a function of laser technology but can also be seen with IPL treatment (Figure 2B) and can be challenging to eradicate, especially on non-facial skin. Patients must be informed of this possibility in the pre-operative phase and even then, much handholding is required.

INFECTIONS

Bacterial, yeast, and viral infections can develop following facial resurfacing procedures. Although prophylactic treatment with antibiotics and anti-herpetics is not based on evidence, it is undoubtedly the standard of care in most localities. Having performed hundreds of full face chemical peels and laser resurfacings over 12 years, I have only seen a handful of documented, culture-proven infections. All



Figure 3 A. Persistent erythema accompanied by itching and burning turned out to be a *Pityrosporum* infections. **Figure 3 B** shows a herpetic infection that broke through prophylactic valacyclovir treatment.

of these infections occurred in closed-wound care treatments with opaque or clear membranes, which can obviously produce a fertile environment for super infection. One challenge was a late-occurring *Pityrosporum* infection that manifested about eight weeks following aggressive CO₂ facial resurfacing (Figure 3). The patient complained of itching and burning and but had



Figure 4

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relatively few lesions. *Pityrosporum* was cultured and responded quite well to ketoconazol therapy. Although this was not technically an infection but rather an overgrowth, the closed-membrane, post-laser emollients and systemic antibiotics empirically used to treat the supposed bacterial infection probably facilitated the *Pityrosporum* infection.

Several years ago, I changed all my wound care to simple petrolatum post peel and laser dressing and have not seen any infections since. Figure 3B shows a post-laser herpetic infection. This patient was treated prophylactically with valcyclovir but still developed significant infection. She responded well when the antiviral medication was adjusted to zoster levels. In retrospect the patient recalled that she was plagued by fever blisters in childhood.

HYPOPIGMENTATION

True hypopigmentation is a rare complication that can occur years after a deep resurfacing procedure (Figure 4A). It is usually associated with over treatment and was common in the days of deep phenol peels. This can be a relatively devastating complication for some patients as the face and neck are distinctly different in color, and makeup must always be worn. I am not sure that there is any guaranteed means of preventing hypopigmentation. If one performs a lot of resurfacing, especially laser resurfacing, it will occur occasionally. I can say that I have seen it in several patients that were so impressed with the rhytids effacement from the laser that they accepted the pigmentation trade off. Avoiding aggressive resurfacing lowers the chance of true hypopigmentation and judiciously hiding the termination of the resurfaced skin in the mandibular shadow

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also reduces the demarcation line.

Pseudo-hypopigmentation is a more common phenomenon and is not actually a melanocyte problem but the difference between rejuvenated facial skin and non-rejuvenated neck skin (4B). I describe this condition to the patient preoperatively by showing them the color difference between the palmar and posterior side of my forearm. The underside is lighter because it has had more actinic protection and the other side is darker due to more exposure. Simultaneous peeling of the neck concomitant with facial lasering can mitigate the skin color between the treated face and untreated neck.

OVERTREATMENT, BURNS, AND SCARRING

Over treatment with permanent scarring is the fear of every practitioner with any aggressive treatment. Although rare, this is a heavily litigated

area. Any treatment that involves the skin—whether ablative or non-ablative laser treatments, chemical peels, and even microdermabrasion and IPL—can cause burns and permanent scarring and/or textural changes. Figure 5 shows an IPL burn that resulted in permanent scarring. Early recognition of healing abnormality with interventional topical and intralesional steroid therapy and silicone sheeting can be very helpful, especially on smaller isolated areas.

CONCLUSION

This scope of this article can only briefly discuss several common complications associated with facial resurfacing. Fortunately, most of these problems are self limiting or respond well to simple therapies. Those pioneers who worked through the original learning curve of aggressive laser treatment made it easier for all of us. The main objective to prevent complications and unhappy patients is to become familiar with the procedures you are performing and the technology behind them. Always be conservative, as retreatment is always an option. Many practitioners get stuck with potentially serious complications when trying new technology that the laser rep guaranteed “was safe for anyone.” Judicious application of new technologies on selected patients as well as collegial interaction and discussion of these new procedures can keep procedures safe and patients happy.

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Figure 5. This patient sustained an IPL burn from overtreatment by a that resulted in permanent scarring. Invasive interventional care minimized the defect.