



## MiXto SX & Pro Fractional CO<sub>2</sub> Laser Pre- & Post-Care Guidelines

### Disclaimer

MiXto SX & Pro fractional CO<sub>2</sub> laser treatments should only be performed by competent and appropriately trained medical personnel, complying with all applicable state and local medical laser safety regulations and clinical application guidelines.

The following instructions are recommendations only and should not take the place of but rather be used in conjunction with sound medical judgement obtained by extensive training and experience.

This document (while not being an exhaustive treatise on the subject) contains basic pre- & post-op guidelines to follow when doing CO<sub>2</sub> ablative fractional resurfacing. It is written with added explanation as it is intended to be used not only by dermatologists and plastic surgeons, but also by physicians with core specialties less familiar with treating/caring for the skin and/or by less skilled non-physician medical personnel (who might assist a physician in using the MiXto SX/Pro laser or use it unaccompanied albeit under direct physician supervision).

Each medical facility should produce their own unique set of pre & post-care instructions for their patients to follow incorporating some or all of the guidelines outlined below as their best judgment dictates.

Healing time will vary according to the degree of treatment, physician skill, skin condition, current medical health, prior medical history, and the patient's willingness to follow post-op care instruction, etc. Although fractional CO<sub>2</sub> treatment is effective in most cases, no guarantee can be made regarding the degree of cosmetic improvement.

Any and all treatment results, outcomes, degree of cosmetic improvement and potential risk of side effects will vary from patient to patient and are the sole responsibility of the treating clinician/practitioner and/or applicable medical director.

### Preface

The MiXto SX & Pro laser resurfacing procedure is ideal for patients of all skin types, for skin both on/off the face, and for treatment of fine lines, skin laxity, wrinkles, sun damage, melasma, brown spots/and numerous other epidermal lesions (some of which might otherwise become actinic keratoses or basal cell carcinomas), acne scarring, hypertrophic (burn & traumatic) scarring, stretch marks, and aid in laser tattoo removal.

Average procedure time is approximately 30 minutes for a full-face mild resurfacing treatment (1 pass), 1 hour for a moderate treatment (2 passes), and up to 2 hours for a very aggressive treatment (3 or 4 passes).

In general, most patients require only a strong topical anesthetic for mild to moderate treatments with additional regional/nerve blocks required for more aggressive procedures.

This document is to be used in conjunction with the "*MiXto SX & Pro - Treatment Settings*" document which contains a guide on selecting the appropriate laser parameters for various skin types and desired medical procedures and the "*MiXto SX & Pro - Basic Customer Inservice Course*" presentation which covers basic laser safety, basic CO<sub>2</sub> laser physics, laser-tissue interaction, and clinical application instruction.

## Pre-Operative Instructions/Concerns:

- **Wear Loose Fitting Clothing:** Patients should come to the office wearing loose fitting clothing that button or zip up the front (rather than a pullover top that has to be pulled over the face and head).
- **Thorough Shower:** Have patient take a good shower with germ inhibiting soap the morning before the procedure and shampoo their hair. This will decrease bacteria on the skin and decrease the risk of infection.
- **Clean Shaven:** Male patients should arrive clean shaven if treatment is to take place on the face.
- **No Makeup:** Female patients should arrive at the office with the area of skin intended for treatment free from any of the following as they will add bacteria to the skin, increase the risk of infection and will have to be removed anyway prior to the procedure:
  - ✓ makeup
  - ✓ cosmetics
  - ✓ creams
  - ✓ perfumes
  - ✓ lotions
  - ✓ powders
  - ✓ or any other skin preparations (except sunblock if applicable)
- **No Hairspray:** If laser treatment is to take place on the face, the patients should arrive without having used hairspray or hair gel as they could be flammable.
- **Hair Pulled Back:** For those patients with long hair they should come to the office with their hair pulled back out of the way of their face.
- **No Earrings:** any shiny metal surface can reflect CO<sub>2</sub> laser radiation and redirect it to somewhere unintended, causing tissue burns or starting any easily flammable material on fire. Also, any earrings made out of plastic (or metal earrings coated with paint) can be damaged (burnt, pitted, melted, or discolored).
- **No Alcoholic Beverages Starting 1 Day Prior to Surgery:** Some practitioners recommend an even longer period of time to abstain from alcohol, anywhere from 3 days to 2 weeks. Alcohol dilates blood vessels and leads to post-operative bleeding. Besides reducing the effectiveness of certain pain relievers, it can also increase the risk and degree of the side effects associated with those pain relievers. Recent research seems to indicate that drinking can reduce the efficiency of the immune system for a time. In short, alcohol increases the risks of complications and slows down the recovery process.
- **Risk of Ectropion** (refer to page 37 section 9 for additional information): Eyelid skin is the thinnest on the body. With advancing age, excessive sun exposure, and the constant pull of gravity, lower eyelid skin and other structures that hold the eyelids in place relax and can start to droop downward and outward pulling the lower eyelids away from the surface of the eye. As the inner surface of the eye is exposed (scleral show) it becomes irritated and a feeling of burning, itching and discomfort soon develop.

Patients who are particularly prone to get ectropion after laser resurfacing are:

- ✓ Those who have undergone previous lower lid blepharoplasty
- ✓ Those with lax lower eyelid skin
- ✓ Those with scleral show
- ✓ Those who have large globes
- ✓ Those who have had a previous chemical peel

- ✓ Those who have undergone a prior aggressive laser resurfacing

In most cases, laser skin resurfacing should be delayed at least 3 months after a lower lid blepharoplasty to give the skin time to return to its normal position if possible. It is safe though to do a lower eyelid transconjunctival blepharoplasty simultaneously with laser resurfacing which can produce excellent results.

In patients where aggressive laser resurfacing is desired under the eyes, a snap test (e.g., snap-back test) should be performed to check the extent of elasticity of the skin beneath the eyes. If the skin is too lax then aggressive laser resurfacing under the eyes should be avoided as laser resurfacing will pull the lower eyelid tissue further away from the eye as it tightens.

The snap test (somewhat subjective) is performed as follows: the patient is asked to look up slightly while the practitioner pulls the lower eyelid down and away from the globe for several seconds; when released, the time is measured that it takes for the lower eyelid to return to its original position (flush with the globe) *before the patient blinks*; normal lower eyelids should reset into their original position immediately (at least within a second or two without a blink); the longer it takes, the more horizontal laxity is present.

One way that the snap test is graded is as follows:

- ✓ Normal (lid snaps back quickly)
- ✓ Mild laxity (slow return)
- ✓ Moderate laxity (incomplete return unless patient blinks)
- ✓ Severe laxity (incomplete return even after blink)
- ✓ A normal lower lid should not be able to be pulled more than 7 mm away from the globe

You can view a short video of the snap-back test being performed at:

<http://www.youtube.com/watch?v=pKHGNV1iqA>

- **Prior radiation treatment:** Re-epithelialization of the skin following ablative laser resurfacing occurs by proliferation of epithelial stem cells in the basal layer of the epidermis and the epithelial lining of the skin's adnexal structures (hair follicles and sweat glands). Previous radiation therapy may reduce the number of these skin appendages thereby lowering the skin's ability to properly heal itself. Care must thus be taken when selecting the laser parameters to be used for the treatment.
- **Stop Smoking:** Smoking cigars or cigarettes, chewing tobacco, using any type of NRT (nicotine replacement therapy) i.e., nicotine gum, patches, lozenges, and nasal sprays/inhalers, and being subjected to second-hand smoke prior to surgery will have a negative effect on healing of the skin after fractional resurfacing and should be avoided for a time before and after treatment.

The three main harmful and toxic ingredients in cigarette smoke are:

- Nicotine – is a vasoconstrictor and as such is the main cause for decreased blood flow in the small vessels and capillaries that supply oxygen to the skin and nutrients and healing factors to wounded tissue. Nicotine also increases platelet formation which increases the risk of blood clots and nicotine reduces the proliferation of red blood cells, fibroblasts, and macrophages necessary for tissue repair.
- Carbon monoxide – is a poison that also lowers the oxygen content in the blood (the same deadly gas that is emitted from car exhausts). It combines with hemoglobin in red blood cells reducing blood's oxygen-carrying capacity, literally driving oxygen from the blood.
- Hydrogen cyanide – is a type of histotoxic hypoxia as it prevents cells from using oxygen. These cells will eventually die. Of all the chemicals in tobacco smoke it causes the most damage to the heart and blood vessels and also damages the respiratory and central nervous systems.

In summary, the ingredients in tobacco reduce the skin's ability to heal itself and restrict the immune system's ability to fight infection. Studies have shown that smokers have a 6 fold higher incidence of wound infection. Smoking also increases the heart rate by 10-20 beats/minute and blood pressure by 5-10 mm Hg. Blood sugar levels during smoking also increase which cause red blood cells to clump together restricting blood flow to smaller capillaries and can result in blood clots leading to strokes and heart attacks.

Other studies have found that bone fractures heal much more slowly (for example, bone fractures normally take 24 weeks to heal but smoking extends that by another 6 weeks). A study of 120 women who underwent a laparotomy had scars that were 3 times wider than non-smokers. Smoking also greatly decreases vitamin C levels. Vitamin C is an anti-oxidant that assists in the formation of new collagen, and boosts the immune system to help fight infection.

It takes 3 full days of not smoking to get rid of all of the carbon monoxide in your blood (once gone oxygen levels return to normal right away). This is why many surgeons recommend (and often times require) their patients to quit smoking 3 days prior to surgery. Even after 24 hours a substantial amount of nicotine and carbon monoxide will be gone, and by stopping smoking a short 12 hours before laser treatment will still be worthwhile.

- **Discontinue Agents that cause Bruising or Bleeding (controversial):** Before laser treatment, patients should be instructed to discontinue any agent or prescription medication that may induce bleeding or bruising unless they are medically necessary such as:
  - ✓ **vitamin E**
  - ✓ **fish oil**
  - ✓ **gingko biloba**
  - ✓ **garlic supplements**
  - ✓ **cholesterol medications**
  - ✓ **Pepto-Bismol**
  - ✓ **Alka-Seltzer products**
  - ✓ **Oil of Evening Primrose**
- and any over-the-counter medications that contain non-steroidal anti-inflammatories such as:
  - ✓ **aspirin** (Bayer, St. Joseph, Bufferin)
  - ✓ **Ibuprophen** (Advil, Motrin, Nuprin)
  - ✓ **naproxen** (Aleve)
  - ✓ **nabumetone** (Relafen)
  - ✓ **indomethacin** (Indocin)
  - ✓ **acetaminophen/aspirin/caffeine** (Excedrin)

**Note:** There are a number of medical studies claiming evidence in the support of or against the above recommendation. Use your own judgement!

**Prior Isotretinoin (Accutane) Use?** For deep chemical peels and 100% ablative laser resurfacing it's recommended to wait 12 to 24 months, but for milder peels such as fractional resurfacing you only need to wait 6 to 12 months.

Science behind Accutane: Accutane (isotretinoin) is an oral medication for inflammatory acne used when conventional oral antibiotics and prescription acne creams haven't worked. It belongs to the family of medicines called retinoids, being similar to vitamin A. We do not know exactly how Accutane works on a cellular level but we do know that besides having anti-inflammatory properties it also affects all four ways that acne develops:

1. Decreases the size and output of both the sebaceous glands and the skin's oil glands, both of which dries the skin in the process.
2. Inhibits angiogenesis (the formation of new blood vessels).
3. Slows down the manufacture of skin cells which are sloughed off into the sebaceous glands and makes them less sticky (less able to clog these pores which leads to whiteheads and blackheads).
4. Reduces the amount of acne bacteria in the sebaceous glands and on the skin surface by reducing the amount of oil where the bacteria live.

More specifically of concern when considering ablative resurfacing is that Accutane also affects the stem cells lining the hair follicles and oil glands. It is these cells (and the oil) that are necessary to properly heal the skin after laser treatment.

It is therefore generally accepted that current or recent Accutane treatment makes the skin more fragile, delays healing and thus increases the risk of hypertrophic scarring and keloid formation. Although some clinicians feel that surgery is safe (after a period of time) once the facial skin starts producing oil nevertheless, given the potential risks of hypertrophic scarring and keloid formation it is prudent to err on the side of caution and wait a minimum of 6 months after termination of Accutane treatment.

**Post-inflammatory Hyperpigmentation (PIH):** PIH is a common universal reaction that can occur following any type of inflammatory response in the skin due to injury, infection, disease, or allergic reaction. The greater the inflammatory response (too aggressive of a treatment with prolonged post-op erythema), the greater the chance of PIH.

PIH occurs due to the release of chemicals in the skin that alter the activity of melanocytes, causing them to go into overdrive producing excessive melanin, with a subsequent increase in pigment transfer into the surrounding tissue.

PIH can occur in people of any age, occurs equally in males and females, the malar region is the most prone to PIH but it can appear anywhere on the skin, and although it can occur in white skin it is more common in darker skinned individuals (due to higher melanocytic activity).

To properly identify those at risk of developing PIH after treatment it is imperative to take into account their ethnic heritage! The patient may appear to be a skin type III, but have an ethnic background that would suggest otherwise. For example, if a light-skinned woman with mixed genetic heritage reports that she is the only blonde in a dark-skinned Mediterranean family, this might indicate a greater predisposition to hyperpigment. Also, if a patient has the tendency to turn dark in areas of minor cuts, scars or abrasions this indicates a higher risk of developing PIH after laser resurfacing.

**Note:** When treating those with darker skin or those more prone to develop PIH, it is recommended to use a lower density (10% - 15% rather than 20%), a shorter pulse width (higher index number) and/or a lower power setting in watts (refer to the MiXto treatment settings guide). Also, due to lighter settings used additional treatments may be necessary (i.e., 3 treatments, 3 – 4 months apart).

**Existing Suntan:** Research has demonstrated that a recent suntan will increase the incidence of PIH in patients undergoing laser resurfacing regardless of skin type. **Tanned skin is injured skin.** The patient with the greatest degree of normal skin color will show a greater epidermal tolerance! This means that tanned skin will heal slower than normal skin and will also be at higher risk to develop hyperpigmentation after treatment.

Patients with existing tans should be instructed to avoid any further sun exposure and return for treatment after the suntan is gone. It is recommended that patients wait a minimum of 7 to 10 days after getting a tan (or after having recently spent a considerable amount of time in the sun) before undergoing treatment. This will give the injured skin time to heal (healed skin is better able to mount a healing response), give the melanocytes time to recover and allow them to return to their normal rate of melanin production.

Although skin can hyperpigment from excessive heat in the complete absence of sun light, the majority of hyperpigmentation is caused by exposure to UV radiation from the sun (or sunlamp), so sun avoidance/sun protection is essential for a period of time after treatment. There is no set length of time after surgery during which a patient must avoid direct solar radiation, the longer the better. At a minimum it should be 2 weeks (or at least until the skin has properly healed).

For some it's more personal and for others it's more cultural, nevertheless a certain percentage of patients become very distraught when presented with even a small amount of PIH. These patients will require substantial hand-holding during the recovery period (less so if the patient is given a frank discussion prior to surgery about associated risks vs. benefits, post-treatment options to lessen the risk or shorten it's duration, with added explanation that PIH is almost always transient, and if they stay out the sun it will eventually go away on its own).

**Topical pre-treatment is recommended for patients:**

- who have skin types 4 – 6
- who have melisma
- who currently have hyperpigmentation
- who have a history of developing hyperpigmentation after a skin injury

These patients have a higher propensity to hyperpigment after fractional laser treatment due to their melanocytes being more active and thus more prone to over react when injured.

We recommend that prior to surgery (4 - 6 weeks for skin types IV, 6 – 8 weeks for skin types V & VI) they use sunblock, practice sun avoidance, and be treated with one of the pre-treatment regimens outlined below.

**Note:** Even light skinned individuals (skin types I – III) can develop PIH after aggressive laser treatment when exposed to sunlight. If desired, topical pre-treatment can be performed for 1 – 3 weeks for these skin types.

PIH is the most common complication after ablative laser resurfacing. This highly pigmented skin may appear as blotchy irregular areas, as individual squares with a sharp boundary, or as more homogenous dyschromia involving the entire treated tissue. It usually appears around 3 to 4 weeks after treatment. With strict sun avoidance it generally resolves by itself within a few weeks but may last for a few months even with appropriate therapy.

When undergoing laser resurfacing avoidance of oral contraceptives is important which can have a hormonal effect on pigment production in conjunction with UV light exposure.

There is no current agreement amongst practitioners as to the best course of action to follow when considering how to lower the risk of PIH. The debate centers on whether any pre-treatment is necessary; if so, which topical agents to use and in what strength, the length of time pre-treatment is to take place, whether or not to stop treatment prior to surgery and if so when, how soon after procedure to resume treatment, and if resumed how long it should be continued, etc. Each practitioner will have to consider for themselves the course of pre & post-treatment he/she will follow based on their training and experience using the contents of this document only as an additional resource.

**Note:** Although there are studies which claim pretreatment is necessary and other studies which claim just the opposite, in an ASAPS survey, 87% of practitioners use some form of pretreatment on their patients prior to laser resurfacing. For liability reasons LASERING USA recommends pretreatment (as well as a similar post treatment).

Past research had shown that hydroquinone (HQ) which inhibits melanin production (available in over-the-counter formulations up to 2% or prescription strength up to 8% or higher) was the most effective agent for treating hyperpigmentation. For this reason HQ has been considered the gold standard of treatment in the USA (despite being banned in the EU, Japan, Australia, South Africa and other countries for general cosmetic use).

The generally accepted course of treatment has been to use hydroquinone (2% - 4%) for skin types IV and (6% - 8%) for skin types V – VI (whether used alone or in combination therapy).

In 1975, a new formula for the treatment of hyperpigmentation was introduced by Kligman & Willis that consisted of hydroquinone 5%, tretinoin 0.1%, and dexamethasone 0.1% (applied twice daily for 8-12 weeks):

- **Hydroquinone** helps stop the formation of pigment.
- **Tretinoin** helps the penetration of hydroquinone, helps reduce the thinning effects of dexamethasone, and helps stimulate the production of healthy new skin.
- **Dexamethasone** (a mild topical steroid) helps reduce the irritation from tretinoin.

This very popular formula as has been used for decades and has come to be known today as “Kligman’s formula”. This triple combination formula was found to be more effective in treating PIH, melasma, and ephelides than any of the three components independently with a greater efficacy and lower adverse effects. In fact, Albert Kligman (a well-known dermatologist) reported that his formulation achieved complete depigmentation in normal skin of black patients when it was applied daily for 5–7 months.

Today, there are many variations of this formula commercially available from most any good compounding pharmacy that have improved on the original Kligman formula using a variety of different ingredients and/or percentages and often adding a sunblock with many non-prescription versions available also.

Skin lightening occurs gradually over time, such that the patient can stop applying the medications once desired lightening is achieved.

At the website listed below you can get an idea of the myriad of different combinations available.

<http://www.patientpharmacy.net/skin-lighteners/>

**Note:** Prescribers can adjust the strength of each ingredient to suit the needs of each patient. These formulations are only available by prescription.

- Hydroquinone 5%, Water-Resistant 5-gram Stick (with or without sunscreen)
- Hydroquinone 3%, Kojic Acid 2% Water-Resistant 5-gram Stick (with or without sunscreen)
- Hydroquinone 3%, Kojic Acid 2%, Ascorbic Acid 1.5% Water-Resistant 5-gram Stick (with or without sunscreen)
- Ascorbic Acid 1.5%, Glycolic Acid 5%, Hydrocortisone 1% and Hydroquinone 5% Topical Lotion (with or without sunscreen)
- Fluocinolone 0.1%, Hydroquinone 5% and Tretinoin 0.1% Cream (with or without sunscreen)
- Hydroquinone 4%, Tretinoin 0.1%, Flucinolone 0.1% and Vitamin E 1.75% Bleaching Cream (with or without sunscreen)
- Hydroquinone 5%, Tretinoin 0.1% and Triamcinolone 0.1% Gel (with or without sunscreen)
- Hydroquinone 5%, Tretinoin 0.05% and Hydrocortisone 2.5% Ointment (with or without sunscreen)
- Hydroquinone 5%, Tretinoin 0.025% and Triamcinolone 0.1% Cream (with or without sunscreen)
- Hydroquinone 6%, Kojic Acid 4% and Tretinoin 0.025% Gel or Cream (with or without sunscreen)
- Hydroquinone 8%, Ascorbic Acid 2% Cream or Stick (with or without sunscreen)

Current research however has proven that there are new products on the market that are as good as or even superior to HQ (this will be discussed later in this document).

**Note:** Some physicians believe just the opposite. They recommend not using higher percentages of HQ on darker skin types because they believe that darker skin is more easily irritated by HQ (thus justifying a lower percentage) and greater irritation carries a greater risk for PIH. You decide!

HQ (particularly in 4% or higher concentrations) can cause an irritant reaction (itching, stinging, or redness) in approximately 25% of patients who use it and a few may develop contact dermatitis. In general, these side effects lessen as you continue to use HQ. If a patient experiences a burning sensation or skin swelling, they should stop using hydroquinone immediately!

**If an allergic reaction occurs, you can do one of the following:**

- Switch to a lower percentage of HQ
- Use HQ less frequently
- Use it for less time (a few hours per day rather than overnight)
- Use HQ in combination with 1% hydrocortisone (which helps counter the effects of the original allergic reaction)
- Use an alternate skin whitening agent or combination therapy outlined below.

### **Proper HQ application prior to surgery:**

1. Test for skin sensitivity before use by applying HQ cream to a small area of hyperpigmented skin. If no itching or redness (or other side effects) occur within 24 hours, proceed with treatment.
2. Prior to applying HQ, clean and dry the skin to remove any dirt, sweat, makeup or excess oil which can impede HQ absorption.
3. Apply only enough to cover the area you wish to lighten. Do not apply to normal un-affected skin as this area will lighten also.
4. Wash your hands thoroughly after HQ application or it will also lighten your palms.
5. Do not apply HQ near the eyes, lips, inside the mouth, or other mucous membranes. Hydroquinone may cause numbness of these areas. If it does get into any of these areas, rinse with water.
6. Using topical HQ together with benzoyl peroxide, hydrogen peroxide, or other peroxide products may cause a temporary staining of the skin. This staining can usually be removed with soap and water.
7. Do not use HQ on skin that is sunburned, dry, chapped, or irritated, or on an open wound. It could make these conditions worse. Wait until these conditions have healed before applying HQ.
8. If desired, apply a moisturizer over the top but best to wait 10 to 15 minutes to allow time for HQ to properly absorb into the skin.
9. Next, apply a broad spectrum sunscreen/sunblock (minimum SPF 15). Topical HQ can make skin more sensitive to sunlight and sunburn may result. Avoid exposure to sunlight or artificial UV rays (sunlamps or tanning beds). In addition if outside in the sun, wear protective clothing.
10. If use of makeup is desired it should be applied last.

### **HQ can be and often is used alone but due to certain side effects and limitations it is commonly combined with other agents such as:**

- **Corticosteroids** - to lessen skin irritation.
- **Retinoids** (retinol & tretinoin) – to enhance HQ absorption by increasing exfoliation and will also reduce melanin production.
- **Other Bleaching Agents**, e.g. Azelaic acid, Kojic acid, Alpha-Hydroxy acids (Glycolic acid, Salicylic acid, Lactic acid) – to promote exfoliation and also inhibit melanin production.
- **Antioxidants**, e.g. Vitamin C & E, Mulberry Root extract, Bearberry extract (Beta-Arbutin), Alpha-Arbutin, Licorice extract, & Emblica extract, to help prevent sun damage and also inhibit melanin production.
- **Sunscreen/Sunblock** – reduce skin exposure to UV radiation.

### **Two common and highly recommended triple combination therapies shown in clinical trials to each produce similar cosmetic improvement of hyperpigmentation out to 12 weeks of use are:**

- **Tri-Luma®** by Galderma (Hydroquinone 4%, fluocinolone acetonide 0.01%, tretinoin 0.05%).

The FDA issued a warning (Aug 10<sup>th</sup>, 2010) that Tri-Luma® is only for short term use (up to 8 weeks). It contains 4% hydroquinone and therefore requires a prescription. Also, it's recommended to not use Tri-Luma® or other cortisone product on older women with very thin skin on the tops of their hands!

- **EpiQuin® Micro** by SkinMedica, Inc. (Hydroquinone 4%, retinol 0.15%, vitamins C & E). EpiQuin® Micro is the only HQ 4% formula to use *Microsponge Technology* which has been shown to provide gradual release of active ingredients into the skin. This lessens the side effects of HQ and retinol (less skin irritation and capillary development reducing erythema) so steroids (and their potential harmful long term side effects) are not needed in the formula.



**Note:** Some physicians recommend that Tri-Luma® (or pharmaceutical equivalent triple combination formula containing a steroid) might be slightly more effective in the short term but EpiQuin® Micro (without the added steroid) would be safer for later long term use.

**Listed below is a sampling of some of the more common alternative treatment combinations for skin whitening that are effective to one extent or another (which can be used to lessen skin irritation):**

1. **HQ (4%) + Tretinoin (.05% - .1%):** The use of Tretinoin, i.e., Retin-A, pre-op will also aid in the healing process post-op. If continued after treatment, tretinoin will help reduce fine lines, wrinkles and skin roughness. It will also inhibit the enzymes that break down collagen and elastin, increase epidermal thickness and stimulate the production of new collagen.
2. **HQ (4%) + Tretinoin (.05%) + Hydrocortisone (1%):** The negative effects of hydrocortisone (thinning of the skin) are countered by the positive effects of tretinoin.
3. **Azelaic Acid (15% - 20%):** Azelaic acid both accelerates exfoliation and inhibits melanin production. Has been found to be as efficacious as HQ with a decreased risk of irritation.
4. **Azelaic Acid (20%) + HQ (4%)**
5. **Azelaic Acid (20%) + Tretinoin (05%).**
6. **Glycolic Acid (15% - 20%):** Glycolic acid accelerates the exfoliation process.
7. **Glycolic Acid (20%) + Azelaic Acid (20%):** This combination was as effective as 4% HQ by itself (but with a slightly higher rate of local irritation).
8. **Kojic Acid (1% – 4%):** Kojic acid inhibits melanin production. Often used in patients that cannot tolerate HQ. Can be used alone or in combination with HQ. Since it has a high sensitizing potential to cause dermatitis, it can be used with hydrocortisone.
9. **Kojic Acid (2%) + Glycolic Acid (10%):** Will both accelerate exfoliation and inhibit melanin production.
10. **HQ + (4%) Glycolic Acid (10%):** This combination was as effective as the combination of **Kojic Acid + Glycolic Acid** (but was reported to be more irritating).
11. **HQ (2%) + Glycolic Acid (10%) + Kojic Acid (2%):** This combination decreased pigmentation better than **HQ + Glycolic Acid** alone.

These combination formulas offer increased safety, provide greater efficacy, and reduce side effects over using HQ alone.

The use of tretinoin, e.g. Retin-A in combination with HQ, is currently the most commonly followed pre-care regimen, but triple combination therapy has been shown to be more effective than dual or single agent (monotherapy).

**Note:** Dual or single agent therapy should only be used when patients develop sensitivities to any of the ingredients used in triple combination therapy.

**New alternative to HQ: Lumixyl™ Topical Brightening Creme** by ENVY Medical Inc. This is a non-prescription, non-toxic, non-irritating, synthetic peptide technology (developed by dermatological researchers at Stanford University) that is clinically shown to significantly improve hyperpigmentation better than HQ with none of the risks!

When used by itself, Lumixyl™ yields visible results in as little as 8 weeks. For accelerated results, the full **Lumixyl Brightening System** can be used to achieve visible improvements in as little as 4 weeks.

Alternatively, Lumixyl can be used in conjunction with an exfoliant, such as a retinoid, for expedited results in the short term.

Lumixyl™ uses Decapeptide-12 which is thought to work by inhibiting tyrosinase, the enzyme responsible for the production of melanin in the skin. In vitro studies show that Lumixyl™ is 5.5 times more effective than hydroquinone at equidose in the moderation of melanin - reducing melanin synthesis by as much as 40 % compared to treatments with hydroquinone, which reduced production by only 7% in the same study. In addition to its efficacy, Lumixyl™ is the only skin brightener to offer all of the following benefits in a single product:

- Non-irritating or allergenic
- Non-toxic
- Safe for all skin types
- Safe for prolonged use
- Easily degraded by the skin
- Will not increase skin's sensitivity to the sun
- Stabilized so that it will not lose potency or turn brown after opening.
- A luxurious, moisture-rich texture

**Lumixyl vs. Tri-Luma™:** A study comparing the prescription medication Tri-Luma® (\$300/tube) vs. non-prescription Lumixyl™ (\$120/tube) showed patients with persistent melasma responded better with the Lumixyl cream.

**A sample of some of the top rated skin whitening products currently on the market:**

- **MelanoLyte Tx™** by epionce®
- **elure™ Advanced Skin Lightening Cream / Lotion** by Syneron Medical Ltd.
- **Meladerm® Advanced Skin Lightener** by Civant Skin Care
- **Skin Brightening Cream** by Dermology
- **Skinbright Premium Concentrate Skin Brightening** by Premium Naturals LLC.
- **Revitol Skin Brightener** by Revitol Natural Skin Care
- **Lucederm Skin Brighten Cream** by Sisquoc Healthcare, Inc.

**Note:** A new product recently became available called **AnteAGE MD Serum & Accelerator** (by Cellese Inc.), which claims (although not officially in writing) to actually prevent PIH from happening if used 4 – 6 weeks prior to treatment. This product was originally created to be used for long term Anti-aging but has now been shown to also be great for general wound healing and for post-laser resurfacing application. Its unique ingredients list stem cell derived cytokines which have been shown to speed up and improve the normal healing process. A recent split face study LASERING USA did against a leading post-laser topical showed that the side treated with AnteAGE MD topicals healed quicker with a shorter duration of swelling and erythema.

**Stop/Don't - Stop skin whitening regimen prior to treatment? Two schools of thought:**

- **Stop** – Some physicians recommend skin whitening treatment be stopped prior to (3 days up to a week or more) the laser procedure to allow time for any existing skin irritation to cease. Skin inflammation can delay healing, prolong post-op erythema and actually increase the risk of developing PIH. If the skin is inflamed or irritated, the laser treatment should be postponed until all irritation has resolved.
- **Don't Stop** - Other physicians not only want their patients to continue using HQ & retinoids (or other similar agents) right up to the day of surgery but even recommend doubling the level of application a few days prior. They believe that a greater level of exfoliation (albeit with a certain amount of irritation/inflammation) post-op will reduce the skins ability to hyperpigment after treatment. **You decide!**

**Resume skin whitening regimen post-op:** wait at least 10 days after treatment to give skin time to heal sufficiently before re-application of possible skin irritants. Continue for 4 weeks applying topically every night (or every other night if excessive irritation occurs). If skin is easily irritated, do not use any retinoid.

**Note:** Extra irritation post-op can lead to PIH. (Taking an antibiotic post-op can lessen irritation, lessen edema, and speed up the healing process.)

Also, any patient who suddenly develops hyperpigmentation post-op should begin following a skin whitening regimen immediately.

**Note:** if topical treatment is begun early after diagnosis (and done aggressively), the hyperpigmentation normally starts clearing within 2 to 4 weeks.

**The Effect of Menstrual Cycle on Laser Induced Hyperpigmentation:** In Dec. 2013 the results of a study was published in the “Journal of Drugs in Dermatology, Volume 12 • Issue 12” (conducted by Saad Al Mohizea, MD) entitled “The Effect of Menstrual Cycle on Laser Induced Hyperpigmentation” which seemed to indicate that the effects of the menstrual cycle do indeed affect the severity of PIH (if it occurs) after ablative CO<sub>2</sub> laser resurfacing.

In summarizing her words she reminds us it is well known that despite having taken all normal precautions, PIH is still unpredictable after laser treatment. Although PIH might not have occurred after earlier treatments, it can spontaneously appear later after a subsequent treatment even when the same settings were used. When this occurs it tends to scare clinicians into lowering their settings to a perceived safer level thus ultimately reducing the overall cosmetic results. It is known that hormones can change the skin's pigmentation physiology and pathology, specifically during a woman's menstrual cycle thus affecting the skin's response to the laser treatment (one example is Melasma which is known to be activated by pregnancy or oral contraceptive pills). In her study it was found that the majority of patients who got PIH after laser treatment had deeper hyperpigmentation if the treatment was conducted either at the beginning and/or after menses (corresponding to phases of the menstrual cycle where both estrogen and progesterone have lower values), but had the lowest amount of PIH when the treatment was performed the day just before ovulation. Since it is not known for sure which specific days during the menstrual cycle may pose a higher risk of PIH, she recommends deferring laser treatment to a safer time when it can be accomplished between menstrual cycles where higher settings can more confidently be used.

#### **Use of Steroidal Anti-inflammatories - Yes/No:**

- **Yes** - Some practitioners recommend use of steroidal anti-inflammatories prior to and/or for a short time (24 to 48 hours) immediately after laser treatment. They believe reducing post-op inflammation, erythema and edema lowers the risk of PIH, i.e. more inflammation – greater risk of PIH.

Besides suppressing the mediums of inflammation during the early phase of healing, steroidal anti-inflammatories also act as vasoconstrictors which reduce any intra-operative bleeding. A reduction in blood flow is beneficial as there is less blood to wash away the topical anesthetic. This is more of an issue with Er: YAG and short pulse CO<sub>2</sub> lasers (unlike the MiXto SX<sup>®</sup>) which deposit minimal heat and hence provide little coagulation.

- **No** - Others decline to use steroidal anti-inflammatories either before or after laser treatment. They argue that the inflammatory response is necessary for proper healing and collagen formation and any reduction in inflammation might be counterproductive, ultimately resulting in less skin tightening and wrinkle/scar reduction.

**Note:** Non-steroidal anti-inflammatories (different from steroidal anti-inflammatories) can exacerbate bleeding and bruising and hence are not recommended.

**If one decides to use some form of steroidal anti-inflammatory there are several way to accomplish this:**

1. A low percentage of potent hydrocortisone ointment, e.g. 0.2% clobetasol propionate, can be mixed with the topical anesthetic and applied 1 hour to 1:15 before treatment.
2. A low percentage of potent hydrocortisone ointment, e.g. .05% clobetasol propionate, can be applied immediately after treatment or even starting the day before the procedure.
3. A steroidal anti-inflammatory solution, e.g. Kenolog (triamcinolone) or Celestone (betamethasone) can be injected intramuscularly immediately before or at the conclusion of the treatment. Some clinicians use Toradol (ketorolac) which also acts as a analgesia during treatment (30 to 60 mg prescribed), but it is not recommended since it is a non-steroidal anti-inflammatory which can cause an increase in bleeding or bruising (although this is very unlikely to cause a problem when doing fractional resurfacing with the MiXto laser due to its normal bloodless procedure).
4. A steroidal anti-inflammatory can be taken orally, such as prednisone, e.g. Delatasone.
5. If using IV sedation, a steroidal anti-inflammatory solution can be given intravenously during laser treatment.

**Avoid Cold Sore Contact:** For at least a week prior and a week after treatment avoid contact with anyone who currently has now or has a history of cold sores.

**Prescribing Anti-Viral Medication for patients prone to herpes breakout:** Because fractional laser resurfacing can predispose patients with a history of herpes simplex virus HSV-1 (oral herpes) [cold sores/fever blisters] or herpes zoster (from earlier chickenpox into shingles) to a reactivation of herpes (during the re-epithelialization part of the healing phase), these patients should be prescribed an appropriate anti-viral medication for prophylaxis.

One study done on patients who underwent full-face (100%) resurfacing who had a history of having had herpes but were not given anti-viral medication prophylactically showed that 50% of these patients had a subsequent herpes breakout.

**Note:** Since a herpetic infection can occur even in patients (albeit a very small percentage) with no prior history of having herpes, some practitioners prescribe anti-viral medication (just to be on the safe side) for all patients, especially since an accurate history of herpes virus infection cannot be accurately obtained (reported histories of herpetic infection by patients is 40 – 60% but up to 80% will have serologic evidence of prior infections so prophylactic use of anti-viral medication based on patient recollection may not be a good approach). Some practitioners prescribe anti-viral medications when performing more aggressive treatments regardless of a herpes predisposition. If treating just around the eyes, anti-viral prophylaxis is probably not necessary.

**Commonly prescribed anti-viral medication dosages for prophylactic outbreak suppression therapy are:**

- famciclovir (**Famvir**), 250 mg PO b.i.d.
- acyclovir (**Zovirax**), 400 mg PO b.i.d.
- valacyclovir (**Valtrex**), 500 to 1000 mg PO o.p.d.

**Note:** Oral valacyclovir is preferred over acyclovir because its oral bioavailability is 3-5 times as great as acyclovir.

Anti-viral medication should be started anywhere from the morning of surgery, 24 hours to several days before treatment (depending on opinion of attending physician). This medication should be continued post treatment for 7 to 10 days or until well after treated skin is fully re-epithelialized. All antiherpetic agents act by inhibiting viral replication in the intact epidermal cells. Therefore, the skin must be fully re-epithelialized before the medication can take full effect.

**Fungal (yeast) infection:** For low risk patients it is generally not necessary to prophylactically prescribe an anti-yeast medication. Nevertheless, if desired, prescribe one dose only of fluconazole (Diflucan), 150 mg PO bid on day 3 or 4 post-op.

For those with an increased risk, it is recommended to start Diiflucan, 150 mg PO bid on day 3 or 4 post-op and taken orally every other day for one week. (Please note that this dosage is much lower than that traditionally prescribed for patients undergoing full-face (100%) ablative laser resurfacing since a fractional laser treatment is much less invasive with an attendant lower risk of infection.

Persons at increased risk of fungal infection include those who:

- have a strong history of yeast infection
- have diabetes
- have angular cheilitis,
- have a suppressed immune system
- have vaginal candidas.

**Prescribing Antibiotics:** There are several schools of thought when prescribing antibiotics and there is no hard and fast rule as to their use during ablative laser procedures. If antibiotics are prescribed, they are done so starting either the day before or on the day of surgery and then continued 5 to 10 days post-op (at least until healing is complete).

- **No antibiotics:** Some practitioners do not believe in prescribing prophylactic antibiotics for their patients pre-treatment. Besides following the generally accepted practice of not prescribing antibiotics unnecessarily (combined with the very low reported incidence of postoperative bacterial infection after fractional resurfacing), they feel that the high quality of after-care they require of their patients lowers the risk of post-operative infection to an acceptable level. (Many physicians claim their recommended after-care is so good that they have never seen a bacterial infection in any of their patients who have undergone ablative fractional resurfacing.)
- **Antibiotics only for patients with a history of acne:** Some practitioners only prescribe antibiotics for patients with a history of acne or in those who currently have acne. Ablative resurfacing has been known to exacerbate any existing acne and has an increased risk of causing a new acne breakout in those who are more prone to get acne.
- **Antibiotics for all patients:** Many practitioners play it safe and just prescribe antibiotics to all patients undergoing any type of ablative resurfacing procedure. Besides outside contaminants possibly entering exposed wounded tissue causing an infection, it is not uncommon for acne flare-up due to application of topical moisturizing ointments i.e., Aquaphor<sup>®</sup>, which have a tendency to clog pores and irritate the skin.
- **Antibiotics only for more aggressive treatments:** When traditional 100% resurfacing is performed it is the generally accepted practice to always prescribe antibiotics. The more aggressive the ablative fractional treatment is (and the closer to 100% resurfacing it becomes), the greater the chance of post-treatment bacterial infection. Therefore, although antibiotics might not be warranted for lighter procedures, they would be used for more aggressive treatments.

**Note:** Systemic oral antibiotics are preferable to most topical antibiotics due to the possibility of allergic contact dermatitis, especially to Neomycin and Bacitracin (Bacitracin has been reported to cause not only contact dermatitis post-resurfacing, but also foreign body granulomas due to its mineral oil content).

**Points to remember:**

- For those with an active bacterial infection it would be better managed by delaying treatment until it has resolved.

- Care should be taken when resurfacing is performed on patients with reduced immune function such as diabetes or those who are immunocompromised.
- The antibiotic must be also in the patient's bloodstream before initiating any surgical treatment. Thus, it must be taken at least one hour before surgery.

The most common occurring bacteria to cause a skin infection following ablative laser resurfacing is staphylococcus aureus, with streptococcus pyogenes following a close second (enterobacter and kiebsiella bacteria are also known microbe to cause infection). Thus, the most prescribed oral antibiotic for prophylaxis is a cephalosporin since it is effective against both of these microbes. Other commonly prescribed oral antibiotics from each of the 5 common groups are listed below along with a few of the major types of bacteria they treat. Please note that there are many other antibiotics and dosages to choose from.

**Common antibiotic regimens include:**

- ✓ a cephalosporin (1<sup>st</sup> generation) - cephalexin (i.e. **Keflex, Zartan**, 500 mg PO qid x5d)
  - Staphylococcus aureus
  - Streptococcus pyogenes
- ✓ a quinolone (2<sup>nd</sup> generation) – ciprofloxacin (i.e. **Cipro**, 500 mg PO bid x5d)
  - Pseudomonas aeruginosa
  - Staphylococcus aureus
  - Streptococcus pyogenes
- ✓ a macrolide - azithromycin (i.e. **Z-pak**, 250 mg PO day one, 500 mg PO next 4 days)
  - Staphylococcus aureus
  - Streptococcus pyogenes
- ✓ a tetracycline - doxycycline (i.e. **Vibra-tabs**, 100 mg PO bid, x7d)
  - Pseudomonas aeruginosa
  - Streptococcus pyogenes
- ✓ a semisynthetic pencillin – Amoxicillin (i.e. **Augmentin** tablet, PO 500 mg bid x7d)
  - Staphylococcus aureus
  - Enterobacter species
  - Kiebsiella species

**Note:** Azithromycin is a good substitute if the patient is allergic to penicillin or cephalosporin.

Of course, any patient who acquires a bacterial infection post-treatment should be also immediately be put on a course of antibiotics. Vigilance is perhaps as important as the antibiotics themselves and is often used in place of prescribing medication.

Deeper ablation (resulting from using higher settings) carries with it an increased risk of a more severe infection (leading to a higher risk of scarring) due to a potential rise in the amount of exuded blood and serous fluid (from deeper wounds) which act as a pathway for external bacteria to gain entry into the skin.

**Complete and sign Informed Consent and Photo Release Forms.**

**Take Pre-Treatment Photos:** Proper lighting and high quality photos are key! Try and take all pre and post-op photos with the same background, lighting and at the same angle to ensure homogeneity.

**Make a list of all medication and dosages the patient is taking.**

**Show Post-Treatment Photo Series:** it's very important for the patient to be aware of how they will look throughout the healing process.

**Stop harsh scrubs and exfoliants (such as products containing alpha hydroxyl or glycolic acids) one week before treatment:** Use of these products up until the time of treatment will extend the length of erythema post-operatively. Stopping these products before surgery will give the skin time to calm down.

**Botox Prior to Resurfacing / key points to ponder:**

- ✓ The medical use of Botox prior to laser resurfacing is relatively new.
- ✓ Very few studies have been done on the combined use of Botox and laser resurfacing but research has proven that Botox used prior to laser treatment will improve cosmetic results.
- ✓ Botox will relax the muscles that make wrinkles allowing post-treatment collagen to form on a smoother scaffolding allowing patients to keep from reinforcing their existing wrinkles. If the area underneath where you are resurfacing is moving a lot the resultant tightening will be less.
- ✓ It typically takes from 3 – 5 days for Botox to take effect so it should be administered at least 3 days before laser treatment.
- ✓ It sometimes takes as long as 10 days for Botox to take effect so some practitioners recommend that Botox be applied 10 days to 2 weeks prior to surgery.
- ✓ The effects of Botox will last 3 – 4 months which coincides with peak post-resurfacing collagen formation which occurs between 3 – 6 months.

### **Dermal Fillers in Combination with Ablative Fractional Resurfacing:**

1. Combining fillers with laser resurfacing is becoming more and more popular although little research has been done on their combined use. Hence, questions remain on the overall safety, long term biological effect, which to use first, and how long to wait between filler and laser application.
2. Some practitioners inject fillers first (immediately prior to laser resurfacing) but if done so, please keep the following in mind:
  - ✓ Current research has shown that non-ablative and superficial ablative laser treatment does not affect the filler material (if injected previously), nor has any denaturation of the filler material been seen even when performing more aggressive laser treatments (even though deeper columns of ablation have come in contact with the filler material).
  - ✓ Nevertheless, if performing laser resurfacing on areas previously injected with filler material, proceed with caution because the belief is held that deeper laser ablation may interact with the filler material and may affect the longevity of the filler and/or efficacy of laser treatments.
3. The question may be asked, if laser ablation can go deep enough to interact with the filler material are there some types of fillers that are more resistant to laser radiation.
  - ✓ Injectable hyaluronic acid fillers (HAFs) such as Restylane<sup>®</sup>, Perlane<sup>™</sup>, and Juvederm<sup>®</sup> bind to water and in theory should be more prone to degradation by CO<sub>2</sub> or Er:YAG lasers which are highly absorbed into water. Sculptra<sup>®</sup> and Radiesse<sup>®</sup> are generally injected much deeper into tissue and are less affected by laser absorption into water.

**Note:** To my knowledge there have now been at least two studies done on using fillers in combination with dermal fillers. Two of the studies are summarized below.

1. Aesthet Surg J. 2008 Sept-Oct; 28(5):503-11

**Effects of common laser treatments on hyaluronic acid fillers in a porcine model.**

Summary; It was found that when IPL, Nd:YAG laser @ 1540 nm, fractional erbium laser @ 2940 nm, and fractional CO<sub>2</sub> laser @ 10,600 nm (Active FX & Deep FX) were used in conjunction with HAFs there was no evidence of morphologic changes to the filler material or surrounding tissues

2. Dermatol Surg. 2007 May; 33(5):535-42.

**A randomized trial to determine the influence of laser therapy, monopolar radiofrequency treatment, and intense pulsed light therapy administered immediately after hyaluronic acid gel implantation.**

Summary; It was found that when IPL, Nd:YAG laser @ 1320 nm, diode laser @ 1450 nm, and monopolar RF were used in conjunction with hyaluronic acid-based dermal fillers on the contralateral side of the face there were no histologic changes.

4. Nevertheless, for safety concerns, most practitioners recommend performing laser treatment first, then injecting fillers at a later date. The amount of time between laser treatment and filler injection varies amongst physicians, anywhere from 1 week to 3 months. Reasons used to justify waiting to use filler material until after laser treatment are:
  - ✓ New collagen continues to form for several months after laser treatment so it's important to wait until most of this change has taken place or you may need more filler than anticipated (unless the filler will be used in an area not affected by laser treatment or you had a superficial laser treatment).
  - ✓ Time is needed after laser surgery for any tissue swelling to go down. HAFs attract water and absorb fluid, any swelling caused by the CO<sub>2</sub> laser may cause the filler material to swell up and create too much fullness
  - ✓ Dermal fillers are generally quite safe when used alone but can have side effects such as bruising, swelling, and pain. Ablative laser resurfacing (even if done correctly) will cause some inflammation and swelling and adding one more variable to the recovery period may worsen any complications if they occur.
5. Although there have been hearsay reports of filler material oozing out during deep laser resurfacing, at the same time, there have not been reports of this happening when performing deep laser treatment in areas where fillers have been placed superficially.

**Note:** One physician starts off using Botox 7 days prior to treatment. Then on the day of the procedure he uses a small amount of dermal filler immediately before laser treatment. He then has the patient come back at a later date (post-op 1 month) to possibly add additional filler if needed.

**Thoroughly Wash the Treatment Area:** Use warm water (this will help open up the pores), a mild soap free cleanser (i.e., Oil of Olay, Dove, Cetaphil, Neutrogena, Aveeno, Aquafil, Bioré, etc.), and a terry towel. Wash aggressively for several minutes and then dry off with a clean towel. This will help assure that the topical anesthetic and laser light will be absorbed evenly. (Rubbing alcohol, acetone or astringent solutions that contain glycolic acid can also be used as a cleanser/degreaser.)

**Apply Topical Anesthetic:** For improved patient comfort, a topical anesthetic can be applied to the treatment area 45 minutes to one hour prior to procedure or 30 minutes prior if treatment area is occluded with plastic wrap i.e., Saran™ Wrap (although occlusion is not recommended due to an increased risk of system toxicity). For greater pain reduction, the topical anesthetic can be applied for 30 minutes, removed, and a re-applied for another 30 minutes. Spending several minutes with your fingertips to gently message in the topical anesthetic will help increase its absorption.

Numerous topical anesthetic creams, gels and ointments containing one or a combination of the following ingredients, lidocaine, benzocaine, prilocaine, tetracaine are available in different strengths and are marketed under different brand names (with tetracaine being the strongest agent).

An extra strong topical anesthetic is needed for moderate to aggressive treatments such as (from strongest to weakest):

- 30% lidocaine
- Dual combination (23% Lidocaine/7% Tetracaine)
- Triple combination BLT (20% Benzocaine/6% Lidocaine/4% Tetracaine).
- Higher strengths of BLT available (20% - 27% Benzocaine/5% - 8% Lidocaine/4% - 11% Tetracaine
- Other high strength combinations (30% Lidocaine/4% Tetracaine/2 to 2.5% Prilocaine

Although topical anesthetics containing a high percentage of lidocaine i.e. 23% - 30%, will provide more pain relief than standard BLT, they tend to wear out well before you finish a standard full face resurfacing procedure



and are therefore not recommended as much as a strong BLT. Nevertheless, there are many physicians who regularly use these higher strength lidocaine topicals. You decide!

**Note:** Gel topical anesthetics absorb into the skin better than creams and creams better than ointments. Nevertheless, we recommend the use of a topical anesthetic cream since gels tend to evaporate too quickly and ointments take too long to get absorbed.

**B.L.T. info:** The reasoning behind using a combination of 3 different types of topical anesthetic is an attempt to provide a uniform level of pain relief over an extended period of time. Of the three anesthetics in BLT, tetracaine is the strongest, lidocaine next in strength with benzocaine being the weakest. As regards to degree of pain relief, 20% Benzocaine  $\approx$  6% lidocaine  $\approx$  4% tetracaine. Benzocaine has the fastest onset of action but the shortest duration of pain relief, lidocaine has a medium onset of action time with a medium duration, and tetracaine has the slowest onset of action but the longest duration of anesthesia. Hence, as the pain relief from one topical starts to wear off, another kicks in, etc.

For mild to moderate fractional CO<sub>2</sub> treatments standard percentage BLT might suffice but a stronger topical is recommend for more aggressive procedures such as BLT of 20%, 8%, 8%.

Any one of a large number of compounding pharmacies located around the US can mix (according to your desired specifications) different combinations of topical anesthetics with higher or lower strengths (i.e., One Stop Pharmacy Inc., [www.onestoppharmacyinc.com](http://www.onestoppharmacyinc.com), 1-877-561-9080).

**Oral Pain Reliever:** For mild pain relief during treatment, an oral pain reliever can be used given 30 to 60 minutes prior to treatment may be given.

**Note:** Do not use aspirin or ibuprofen or medications that contain aspirin or ibuprofen as they interfere with blood clotting. You may use 500 – 1000 mg of acetaminophen (Tylenol or generic equivalent) as it does not interfere with blood clotting.

When performing a more aggressive treatment, a higher strength topical and/or additional anesthesia may be given such as:

- regional nerve blocks (supraorbital, infraorbital, supratrochlear, mental)
- additional local tumescent anesthesia (subcutaneous infiltration) in areas where regional nerve blocks don't reach
- oral narcotics, such as:
  - ✓ **Tylenol #3** (acetaminophen with codeine)
  - ✓ **Codeine** (no brand names)
  - ✓ **Lorcet, Lortab, Vicodin** (hydrocodone with acetaminophen)
  - ✓ **Hydrocodone** (Hysingla ER, Zohydro ER)
  - ✓ **OxyContin, Roxicodone** (oxycodone)
  - ✓ **Percocet** (oxycodone with acetaminophen)
  - ✓ **Demerol** (meperidine hydrochloride)
  - ✓ **Dilaudid** (hydromorphone hydrochloride)
- intravenous (IV) conscious sedation (also called "twilight anesthesia")
- mild oral sedative/anti-anxiety medication taken 1 to 1 ½ hour before surgery such as:
  - ✓ **Ativan®** (lorazepam)
  - ✓ **Valium®** (diazepam)
  - ✓ **Xanax®** (alprazolam)
  - ✓ **Vistaril®, Atarax®** (hydroxyzine)
- intramuscular (IM) sedation such as midazolam (**Versed**)
- conscious intravenous (IV) sedation e.g. twilight anesthesia
- general anesthesia

**Note:** Please be advised that when using stronger anesthesia, it's possible to mask the amount of damage being done to the tissue as the patient is not able to properly ascertain the degree of heat (via pain level) that

is being dumped into their skin! Excess heat can lead to adverse side effects so it's very important that proper after-care instructions be given to the patient with added emphasis that they are strictly adhered to!

A number of physicians have started using a different injectable anesthetic called "Citanest® Plain DENTAL" (rather than 1% or 2% Lidocaine). Citanest® is the one most used by dentists (contains 4% Prilocaine HCL) which is supposedly less painful when injected due to a more neutral PH level. Check it out!

### **Methods Used to Reduce the Pain of Injection:**

- Using smallest gauge needle (25 to 30)
- Warming the solution
- Injecting slowly
- Buffering with sodium bicarbonate; 9 parts of lidocaine (1 to 2%) to one part sodium bicarbonate (8.4%)
- Pinching the skin at site of injection
- Distraction techniques (using a vibrator on or squeezing an extremity)
- Cryotherapy at injection site
- Raising the PH level of anesthetic (may decrease shelf life to 1 week)

**Note:** A recent article in the Journal of Drugs in Dermatology (J. Drugs Dermatol. 2012;11 (10): e39-e42) found that pain and discomfort during subcutaneous injection of lidocaine can be reduced (less pain than when using sodium bicarbonate) by diluting the anesthetic with normal saline in a 1:10 ratio.

**Remove Excess Topical Anesthetic Immediately Before Procedure:** any excess topical cream, gel or ointment on the skin's surface will absorb some of the laser energy reducing its absorption.

**Note:** Even when using a good BLT topical anesthetic the anesthesia often times starts wearing off before the end of longer procedures. It is therefore recommended to only wipe off the topical anesthetic in the particular area you intend to treat next, leaving the other areas covered to let the anesthetic continue to take effect. Likewise, if nerve blocks (or local anesthetic infiltration) are necessary, only do so for areas you are going to treat next as their effect might wear out too soon also.

**Use of Steroidal Anti-inflammatories (Controversial):** Some practitioners recommend the use of steroidal anti-inflammatories prior to the laser procedure (non-steroidal anti-inflammatories can exacerbate bleeding and bruising and hence are not recommended). They do this to reduce post-treatment inflammation (redness and swelling), and pain. Others argue the inflammatory response is necessary for proper healing and collagen formation and any reduction in inflammation might be counterproductive, ultimately resulting in less skin tightening and wrinkle/scar reduction.

Besides suppressing the mediums of inflammation during the early phase of healing, steroidal anti-inflammatories also act as vasoconstrictors which will reduce any intra-operative bleeding. This is more of an issue with ablative fractional lasers, i.e., erbium and SP/UP CO<sub>2</sub>, which deposit minimal heat and provide little coagulation. Proponents of using anti-inflammatories also feel that a reduction in blood flow is beneficial as there is less blood to wash away the topical anesthetic.

**If one decides to use some form of steroidal anti-inflammatory there are several ways to accomplish this:**

1. A low percentage of potent hydrocortisone, e.g. 0.2% clobetasol propionate, can be mixed with the topical anesthetic and applied 1 hour to 1:15 before treatment.
2. A low percentage of potent hydrocortisone ointment, e.g. .05% clobetasol propionate, can be applied immediately after treatment or even starting the day before the procedure.
3. A steroidal anti-inflammatory, e.g. Kenalog (triamcinolone) or Celestone (betamethasone), can be injected intramuscularly immediately before or at the conclusion of the treatment. Some clinicians use

Toradol (ketorolac), but it is not recommended since it is a non-steroidal anti-inflammatory which can cause an increase in bleeding or bruising.

4. A steroidal anti-inflammatory can be taken orally, such as prednisone, e.g., Delatasone.
5. If using IV sedation, a steroidal anti-inflammatory solution can be given intravenously.

**Note:** An intramuscular sedative i.e. Versed (slightly stronger and faster acting) could also be given.

**Vitamin C (1000 mg daily) starting 2 weeks prior to the treatment, and continuing daily for 3 to 6 months post-treatment (recommendation only).** Histamine levels increase after tissue injury which contributes to inflammation. Vitamin C is a natural antihistamine, reducing the body's production of histamine. Vitamin C also improves tissue growth and wound repair, helps heal scars and bruises, and helps the body not only produce new collagen but also provides added tensile strength to newly formed collagen.

**Laser Safety Eyewear / Metal Eye Shields / Corneal Eye Shields:** If applying the laser beam off face, the patient can wear laser safety eyewear. If applying the laser beam anywhere on the face (except intra-orbital), use metal eye shields. If applying the laser beam within the orbit, use corneal eye shields.

When using corneal shields it is recommended that you numb the eyes with a topical anesthetic and lubricate the corneal shields with a lubricant eye ointment; see below:

There are a number of available topical anesthetic drops to numb the eye when using corneal shields. The two most common ingredients are:

- tetracaine (0.5%), brand name **Pontocaine**
- proparacaine (0.5%), brand name **Alcaine, Ophthetic**

**Note:** In a side by side comparison of tetracaine and proparacaine eye drops, proparacaine was preferable due to the fact that it caused less pain upon instillation and lasted slightly longer than tetracaine (rumor mill is reporting that tetracaine eye drops are pretty much not used anymore due to the high number of allergic reactions and pain experienced by patients and has been known to cause severe eye irritation in some people).

As for the corneal shield lubricant, any common over the counter **lubricant eye ointment** (not gel or liquid drops) will work which you can buy at any pharmacy like CVS, Walgreens, or pharmacies at Target, Wal-Mart, etc. **Lubricant eye ointments** contain white petrolatum and mineral oil. The ointment dissolves when coming in contact with the cornea producing a transparent, lubricating and moisturizing film on the surface of the eye.

**Common lubricant eye ointments:**

- **Refresh® Lacri-Lube®** by Allergan, Inc.
- **GenTeal® PM** by Novartis
- **Puralube** by Fera.
- **Refresh P.M.** by Allergan, Inc.
- **Tears Naturale® P.M.** by Alcon

**Rinse/Wash Eyes After Corneal Eye Shield Use:** After the procedure is done and the corneal eye shields are removed (if used), remember to rinse/flush the patients eyes with an appropriate eye wash solution such as BBS® (Balance Salt Solution) by Alcon or equivalent.

**No Contact Lenses:** If the laser treatment will be on the face instruct the patient to remove their prescription contact lenses if applicable before arriving at the office.

**No Intra-Operative Epidermal Cooling:** Although cooling of the epidermis during an ablative laser resurfacing treatment with forced refrigerated air i.e., Zimmer Chiller, will reduce patient discomfort and post-op side

effects, recent research has shown\* that it may also decrease the effectiveness of the procedure by shrinking the diameter of the microscopic zones of thermal injury. Nevertheless, there are a few physicians who use intra-operative cooling and claim that they do not see any reduction in the cosmetic results. Also, it's virtually impossible to efficiently evacuate any resultant laser plume when directing high velocity cold air at the lasing site! You decide!

**\*Effects of Skin Temperature on Lesion Size in Fractional Photothermolysis**

Hans Laubach, MD, Henry H. Chan, MD, Francisca Rius, PhD, R. Rox Anderson, MD, and Dieter Manstein, MD  
*Lasers in Surgery and Medicine* 39:14–18 (2007)

## Post-Operative Instructions:

**Note:** Failure of patients to precisely follow prescribed post-op care instructions can lead to complications and scarring!

### Post-Treatment Skin Care Phases:

1. **Burning Phase (up to 3 hours):** cool tissue, keep moist.
2. **Re-epithelialization/crusting Phase (days 1 – 2):** keep moist, use soaks, prevent infection (bacterial, viral, fungal). Patient will probably look the worst 48 hours after treatment.
3. **Exfoliation/shedding Phase (days 3 – 5):** use complex moisturizers, can apply sunblock if going outdoors, can use hypo-allergenic makeup, don't pick!
4. **Final Healing Phase (days 6 – 7 or longer):** Resume skin whitening regimen if applicable, start long term skin care / sun avoidance / up-regulate collagen production.

**Note:** use of more aggressive settings or treating off face will lengthen duration of phases. Immediately post-op and up to 3 hours after treatment, the treated area will have a slight burning sensation similar to sunburn. The degree and duration of the burning sensation is dependent on type and strength of topical anesthetic (or other anesthesia) used and the aggressiveness of the treatment.

It is of the utmost importance that the treated area is cooled immediately post-op to keep residual heat in the scanned tissue from building up to a dangerous level where it can cause blistering (which can lead to infection and/or scarring) and PIH. The particular epidermal cooling method utilized is of secondary importance to the end result of restricting heat buildup.

**Post-Treatment Epidermal Cooling:** Immediately post-op, cool the treated tissue before the patient leaves the office. Aggressive cooling should be utilized anywhere from 15 to 45 minutes depending on level of treatment. If required, additional cooling can be utilized after the patient returns home (which will aid in reducing pain and swelling).

**Note:** During treatment, the tissue will begin heating up immediately after applying laser radiation and within 15 minutes the patient will start to feel their skin get warm. For short procedures lasting 20 to 30 minutes, tissue cooling can wait until the end of the treatment. For longer treatment sessions (those lasting 45 minutes to 1 hour or more), it is beneficial to start cooling tissue treated early on while continuing to treat any remaining areas.

**Below is a list of various epidermal cooling techniques listed in descending order from most effective to least effective (in my opinion):**

**Note:** Never put ice directly on the treated skin for more than a few minutes unless the ice is wrapped in some sort of protective covering (such as a towel) as this can cause frost bite!

- ✓ **Cold compress soaked in ice water** (i.e. 4" X 4" gauze pad, soft wash cloth, cloth diaper). Changing them once they become warm. (Using water also helps keep the skin moist!)
- ✓ **Cooling mist spray:**

- **Oxy-Mist** by BiO<sub>2</sub> Cosmeceuticals (very effective but also the most expensive)
  - **Thermal Spring Water Spray** by Avène
  - **Thermal Spa Water** by Vichy Laboratoires
  - **Thermal Water Spray** by La Roche-Posay
  - **Cold distilled water** from a spray bottle (cheap but effective)
- ✓ **Forced refrigerated air:** (i.e. Zimmer Chiller; tends to dry out the skin. Better to use in conjunction with wet cold compresses.)
  - ✓ **Water soluble gel:** (see middle of page 21). As gel evaporates, skin temperature is reduced as heat is released into the surrounding air.
  - ✓ **Cold gel compress or gel cooling mask:** (e.g. “Ice Mask CosMedical” by Liquid Ice or “Pearl Ice Cooling Mask” by Inka).

**Note:** Gel compresses are better than ice packs; they don’t leak, are easier to use and are more comfortable (they conform better to the contours of the face and neck and are lighter putting less pressure on the skin). Also, cold gel compresses are quickly chilled in the freezer in about 10-15 minutes.

- ✓ **Ice pack:** (e.g. bag of crushed ice, bag of frozen peas or corn) for 10 to 15 minute intervals (to avoid possible frost bite).

**Note:** If regional nerve blocks containing lidocaine were used during treatment (or dermal filler with lidocaine, i.e. Sculptra® immediately pre-treatment) there is a higher risk of developing frostbite (due to the patient not being able to give reliable pain feedback) if an ice pack is used and left on too long post-treatment. You can have an indication the skin is cooling down verbally via patient feedback, visibly by assessing skin color and by feel using the back of the hand. As cooling of the treated area progresses, the skin will slowly become less red and angry looking and change to a lighter pink color.

- ✓ **Chilled Hand-Held Metal Roller**

**Healing Process:** The tissue healing process begins soon after treatment. Re-epithelialization is usually complete within 48 hours (due to the small percentage of ablated tissue when doing fractional resurfacing) depending on the aggressiveness of the laser treatment and quality of prescribed after-care.

During the early stages of healing inflammation causes capillaries near a wound to dilate and become permeable, allowing fluid from the circulatory system (serous) and lymphatic system (lymph) to leak into the site of injury. This fluid, called exudate, is pale-yellow or straw colored, provides moisture to the wound bed and contains healing agents both of which assist the body in the healing process.

Healing starts with the migration of epidermal keratinocytes from islands of undamaged tissue and from nearby epidermal adnexal structures (sweat glands, sebaceous glands, & hair follicles) to the edges of the laser wounds. This migration of epithelial cells continues horizontally across the wound bed until the epithelial cells grow together. Next, the undifferentiated keratinocytes start the differentiation process, dividing and migrating upwards to recreate a new epidermis.

A moist environment will aid in keratinocyte migration during the healing process, therefore it is essential that the skin be kept moist until re-epithelialization is complete. Initially, some exudate is good which acts as a natural wound covering, provides the wound with nutrients and growth factors, controls infection, and supplies moisture to the wound all of which aids in the natural healing process. Nevertheless, if this biologic material is allowed to buildup (even if it is kept moist) it can eventually retard effective epithelialization, foster colonization of bacteria causing infection, resulting in slower healing and dermatitis.

If the exudate is allowed to dry out and form a crust or scab, it will impede healing even more, will increase pruritis (itching), and if peeled off prematurely, can lead to scarring. Patients should be refrained from inappropriately removing any crusting.

**Apply a hypo-allergenic non-complex occlusive moisturizer:** Once the treated area is sufficiently cooled post-operatively, it is then necessary to apply a thick layer of hypo-allergenic, fragrance-free moisturizing ointment to the treated area. Use clean or gloved fingertips (or wooden tongue depressor) to minimize contamination from dirty hands.

This will accomplish two things; first, it will help fight infection by protecting the skin from outside contaminants and bacteria, and second, by keeping the skin moist it will shorten healing time (occlusivity is initially very important to give time for the exudate to aid in the body's natural healing response) reducing the risk of scarring. This thick occlusive ointment should be applied for the first 48 hours until the skin has re-epithelialized.

**Note:** Use of overly occlusive ointments for extended time can prolong and deepen the exfoliation process and extend the recovery phase!

Because some patients are not compliant with post-care instructions, it's best to not send them home (for liability reasons) until you have applied a layer of moisturizer on their skin. (If anything it gives you the peace of mind that their skin was moisturized at least once post treatment.)

Many ointments (especially those which contain some percentage of petrolatum) trap heat so do not apply an ointment until the skin has substantially cooled! This should be the last step before they walk out the door.

Experience has shown that use of complex moisturizers containing ingredients used to increase healing and shorten downtime have a higher incidence of allergic reactions (contact dermatitis) especially if used on broken skin before the tissue is re-epithelialized. Therefore, some practitioners recommend that during the first 48 hours, a simple non-complex moisturizer be used that does not contain any active biologic agents. This will reduce (although not eliminate) the chance of skin irritation which they believe is more important than reaping the healing benefits from a more complex post-laser treatment moisturizer.

**Note:** Any ointment applied topically (especially before re-epithelialization is complete), even ones that are hypo-allergenic may produce contact dermatitis in some people. If an allergic reaction occurs, the topical ointment should be stopped and treatment begun using a strong topical steroid.

**Below is a list of several generally accepted/recommended hypo-allergenic non-complex moisturizers that can be used immediately post-op:**

- ✓ **Pure Petroleum Jelly** by Vaseline® (100% petroleum jelly)
- ✓ **Aquaphor® Healing Ointment** by Eucerin (41% petroleum jelly, mineral oil)
- ✓ **Elta Hydrovase™** by Elta MD™
- ✓ **Catrix® 10 Ointment** by Lescarden, Inc.
- ✓ **Marini BioShield Immediate Post Procedure Recovery Complex** by Jam Marini Skin Research, Inc.

**Note:** There is also a newly released product by SkinMedica, Inc. called **SkinMedica Restorative Ointment** which is a non-petroleum based ointment (using vegetable-based skin conditioners instead), designed specifically for use after laser treatment, IPL and chemical peels to further reduce skin irritation and lower the incidence of clogged pores leading to acne breakout and milia during the re-epithelialization process. This product is as occlusive as petroleum jelly yet has a much lower propensity to clog pores!

- **AnteAGE Stem BioGel** by Cellese Inc. is a very new topical gel that is also vegetable based (its main ingredient is a vegetable oil gel that is actually edible!) yet still maintains high occlusivity without the drawbacks of petrolatum, etc. (similar to SkinMedica Restorative Ointment but even better as it contains true anti-bacterial, anti-fibrotic, and anti-inflammatory benefits). And unlike petroleum based products, AnteAGE Stem BioGel can be used for the entire peeling process

The following three hypo-allergenic (no ocular irritation) water soluble gel moisturizers can be used as an alternative to the above. Since they are water based they tend to evaporate quickly which requires they be applied more frequently but have the added benefit of being less occlusive lowering the chance of clogging

pores, etc. You can apply these products for the next 48 hours if applied frequently or alternatively just use these products for only the first few hours until the skin is completely cooled down and then switch to the one of the more occlusive products listed above.

- ✓ **Thermal Spring Water Gel** by Avène
- ✓ **Daily Hydrating Gel** by Dr. Lin Skincare
- ✓ **Humatrix® Microclysmic Gel** by Care-Tech Laboratories.
  - When applied at room temperature the epidermis is cooled by 8° to 12° F within 3 or 4 minutes as it evaporates. Contains wound healing ingredients, has bacteriostatic properties, and maintains a sterile and moist environment.

**Note:** Using a moisturizer that has been refrigerated will continue to aid in tissue cooling and reduce post-op edema and discomfort.

**No petroleum jelly or oil based moisturizers post-op until skin has cooled down:** Although many clinicians topically apply petroleum based products such as Vaseline® or Aquaphor® immediately after ablative laser resurfacing, in actuality, petroleum ointment traps heat (as will any greasy or oily substance) inside the wound making the burn worse! After the patient's skin has been substantially cooled down post-op however, they can be used as a dressing to help heal and protect the treatment area. If used, use a new jar or tub to prevent contamination.

**Crisco® Vegetable Shortening not recommended post-op:** Crisco® vegetable shortening is sometimes used since it is known to be very hypo-allergenic. Since it also will trap heat it therefore should not be used immediately post-op until the skin has been cooled. If used at any time in the healing process, please note that it is very occlusive being much too heavy for your skin and can clog pores increasing the risk of milia and acne. There is also some question about its sterility which if contaminated with germs could increase the chance for post-op infection.

**Moisturizing Process:** Exudate can be kept moist by applying copious amounts of topical moisturizer periodically (3 to 4 times a day minimum) or whenever the skin starts to feel dry.

**Note:** There is increased evidence that the proper use of emollients will dampen the immune reactions and lessen the degree and duration of post-op inflammation although the use of thick occlusive ointments for too long (without doing cleansing/soaks every few hours) can prolong and deepen the exfoliation and recovery phase.

**Gentle Cleansing:** Gently cleanse/wash face (or other treated area) with a mild cleanser (i.e., Cetaphil or SkinMedica Sensitive cleanser) several times a day. Lather your hands then pat gently on your skin. Afterwards, softly pat dry your face with a clean towel or washcloth without any rubbing.

**Soaks:** After cleaning the treated skin, it is next important to soak the treated tissue (starting the next morning) using a soft cloth saturated in plain water, saline, or dilute hydrogen peroxide (alternatively, a dilute vinegar solution can be used as explained below).

This will help keep the skin moist, will aid in removing any exudate build-up (crusting) and will also allow the moisturizing ointment (applied immediately after soaking) to better penetrate the surface of the skin.

As re-epithelialization progresses, the frequency of cleansing/soaks (and re-application of an ointment) can be slowly tapered off (from every 2 – 3 hours initially to every 4 – 5 hours later on). After 48 hours (or once sufficient re-epithelialization has occurred so the skin is no longer broken) switch to a mild less occlusive moisturizer with/without sunblock. Once the peeling process is complete washes and soaks can be discontinued altogether.

**Note:** At a minimum gently splash your face with warm water every few hours. This needs to be done until all crusting has subsided.

**Vinegar Soaks:** Gentle cleaning and soaking with a diluted vinegar solution (which is mildly acidic) will help dissolve any unwanted material from the wounded skin use, alleviate pain (soothing), promote healing, and inhibit bacterial growth (especially against pseudomonas and gram negatives).

Vinegar has a tonic action that promotes blood circulation in the small capillaries that irrigate the skin. It is also antiseptic, preventing the proliferation of bacteria, viruses, or yeast that triggers infection. It can dissolve excessive fatty deposits at the skin surface, dissolve and cleanse any necrotic material, and reduce scaly or peeling conditions. Lastly, vinegar regulates the pH of the skin.

This is just another weapon in your arsenal of things to use to improve the overall clinical outcome! **Vinegar soaks regimen:** If vinegar soaks are used, they should be started in the morning on the day after surgery and continued until all crusting is gone and the skin has re-epithelialized.

1. Thoroughly wash hands before touching the treated area (use antiseptic soap).
2. Prepare a water/vinegar solution as follows:
  - Mix 1 teaspoon (5 ml) of plain white vinegar with 1 cup (237 ml) of cool tap water (some physicians recommend using distilled water). If this solution stings or burns, dilute vinegar solution by using 1 teaspoon to 2 cups (1 pint) of water. This solution may be mixed a head of time and put in the refrigerator. Prepare a new solution each time to prevent contamination.
3. Take a clean wash cloth (gauze pad or cotton swab) and soak it in the water/vinegar solution. Ring out any excess and then lay it over the treated area for 10 to 15 minutes. Do not rub vigorously but using the wash cloth you may gently remove (don't pick) any loose crusting.
4. When done soaking, gently pat the treated area dry with a clean soft towel. You can't soak too much. Soaking will reduce redness and speed healing. Note, you do not have to remove all of the moisturizer from off your face during the soaking process.
5. Next, reapply the cooling ointment generously.
6. Repeat this procedure 3 to 4 times daily until all crusting is gone.

The more aggressive the peel, the more benefit can be derived from using vinegar soaks. For very mild peels, vinegar soaks may not be necessary.

**Shower Steam:** The patient can also stand in a hot shower for 30 to 45 minutes to let the steam moisten and loosen the exudate material. When doing so do not run the hot water directly on the face although afterwards you can use cool or lukewarm water from the shower head to gently aid in rinsing off the exudate.

**Once the skin has re-epithelialized to some extent** (usually within the first 48 hours) and is no longer broken an additional thing to do to speed up the exfoliation process (removal of the crusting) is to use some type of papaya or pineapple exfoliating enzyme wash (i.e., Phoenix Medical Incorporated) several times a day in lieu of using dilute vinegar soaks.

**Note:** a non-irritating hypoallergenic makeup (i.e., mineral makeup) can be used (starting day 3) to cover any remaining crusting if desired although it's probably best to wait until the exfoliation phase is totally complete to apply makeup.

**Once the Exfoliation Phase is Complete** (skin is not broken, crusting phase has subsided, & treated area is smooth and pink): soaks and ointments are discontinued, normal makeup and sunblock (SPF 30 or above) can now be applied and the patient can start using a mild moisturizer (or moisturizer designed specifically to improve healing after ablative laser treatment).



**Besides containing ingredients that moisturize, provide a barrier to outside contaminants, and promote healing to reduce recovery time, other qualities to look for in a post-laser skin care product are ones that are:**

- ✓ fragrance Free
- ✓ colorant Free
- ✓ preservative free
- ✓ PH-balanced
- ✓ anti-inflammatory
- ✓ hypo-allergenic
- ✓ paraben free
- ✓ lanolin free

**Other traits to look for in a post-laser resurfacing moisturizer are ones that:**

- ✓ reduce edema (swelling)
- ✓ reduce erythema (redness)
- ✓ helps prevent weeping (oozing) and crusting (absorbs exudate)
- ✓ are non-comedogenic & protect against the formation of milia
- ✓ increase skin exfoliation
- ✓ resist bacterial contamination/infection
- ✓ increase collagen production
- ✓ reduce the risk of PIH
- ✓ and are soothing

**Complex Moisturizers:** If use of a complex healing ointment or cream is desired post-op (either immediately post-procedure or after re-epithelialization), there are numerous products to choose from, marketed specifically for use after laser treatment. Many of these moisturizers claim to have been clinically proven to shorten tissue healing time.

**Although not necessarily having all of the above traits, listed below is a sampling of some of the more common products on the market specifically designed to enhance healing after laser resurfacing, dermabrasion or chemical peel:**

- ✓ **AnteAGE MD Serum & Accelerator** by Cellese Inc. (contains human stem cell derived cytokines)
- ✓ **Protective Recovery Balm** by BiO<sub>2</sub> Cosmeceuticals
- ✓ **Post Laser Treatment Gel** by Régima<sup>®</sup> Skin Treatments
- ✓ **Post Laser Gel** by Visual Changes<sup>®</sup>
- ✓ **Biafine<sup>®</sup>** by OrthoNeutrogena
- ✓ **Cicalfate Restorative Skin Cream** by Avène
- ✓ **Z Calm Post Laser Revitalizing Cream** by Creative Technologies, Inc.
- ✓ **Post Laser Ointment** by Physicians Complex<sup>®</sup>
- ✓ **Res-Q** by One Stop Pharmacy Inc.
- ✓ **Donell Post-Procedure Ointment** by Donell Super-Skin
- ✓ **Complex CU<sub>3</sub><sup>®</sup> Intensive Tissue Repair Crème** by ProCyte Corporation
- ✓ **Laser Post Procedure Balm** by Elta MD<sup>™</sup>
- ✓ **Bio-restorative Skin Cream** by Neocutis
- ✓ **Rescue Post Treatment Crème** by Four Seasons Skin Care
- ✓ **Laserfade Post Laser Gel** by Hanson Skincare
- ✓ **Humatrix<sup>®</sup> Microclysmic Gel** by Care-Tech<sup>®</sup> Laboratories Inc.
- ✓ **Post Skin Resurfacing Balm** by DermaQuest<sup>™</sup> Skin Therapy
- ✓ **pHaze 17 ReBalance** by PCA skin<sup>®</sup>
- ✓ **Post Peel Quick Recovery** by DLC Dermatologic Cosmetic Laboratories<sup>®</sup>
- ✓ **Clarifying Hydrate Conditioning Cream** by Glytone<sup>®</sup>
- ✓ **revaléskin<sup>™</sup> Intense Recovery Treatment** by WWWEnterprise, Inc.

**Note:** Whether to use a post-laser treatment moisturizer or not, if so, which brand and when to start its application is a medical question each practitioner will have to make for themselves.

If a skin bleaching regimen was prescribed pre-op, it should not be resumed until at least 7 to 10 days post-op (or at first sign of PIH) in order to assure that the skin is sufficiently healed up.

**Makeup:** The patient can now apply water-based or mineral makeup. Purchase new application sponges or brushes as infection or acne eruption can be due to accumulated bacteria.

**Note:** Patients should be warned that their skin will be more susceptible to irritation from makeup and hence it should be applied cautiously and conservatively. If irritation occurs they should switch to something less sensitizing.

**Sunblock:** Patients can now start using a full-spectrum (UVA & UVB) sunblock.

UVB radiation causes sun burn, UVA radiation causes an increase in melanoma & pigment change. Do not use sunscreens since they absorb UV light and release it as heat into the skin. (There is some evidence that heat alone can lead to PIH.) Rather, use sunblock which deflects or scatters (blocks) UV light. Use sunblock with a SPF of 30 or higher. SPF is a universal measurement of how well you are protected from UVB radiation. No comparable standard exists for UVA radiation. So for UVA protection, use a high quality sunblock containing one or both of the following ingredients: micronized titanium dioxide or zinc oxide of greater than 10%.

**Also, do the following:**

- ✓ Avoid all direct sun exposure for 3 – 5 days or longer (at least until redness is completely gone).
- ✓ If patient must go outside, use sunblock of SPF 30 or higher
- ✓ Apply ½ hour before going outside for improved protection.
- ✓ Use sunblock for at least two weeks (3 – 6 months is better) after treatment any time outside in sun. (Sun avoidance and use of sunblock should be a life-long endeavor.)
- ✓ Use a mirror to apply sunblock evenly.
- ✓ Must be reapplied every 2 hours to be fully effective (especially between the hours of 10 am to 2 pm).
- ✓ Also use physical blockers such as hats, scarves and sunglasses when possible.

**Note:** New research suggests that sunscreen (even SPF 50) cannot be relied upon to protect the skin against the deadliest form of skin cancer (melanoma). Scientists found that although sunscreen offered some protection against DNA damage, harmful UV rays were still able to penetrate leading to cancerous tumors (although fewer than those who did use sunscreen). “This study highlights the importance of combining sunscreen with other strategies to protect the skin when outdoors, including wearing hats, loose fitting clothing, and seeking shade when the sun is at its strongest.”

**Elevate Head:** When sleeping the first night or 2 after treatment, elevate the head by 45° using 1 pillow under the small of your back and 2 pillows under the head and shoulders to help reduce any swelling. Placing a pillow under each elbow will help you stay in position.

**Bath/shower:** The patient can shower or bath at any point in time post-operatively (although better to wait until the next day). Avoid hot showers or baths for the first 24 hours. Preferably take short warm showers. (Cold showers may be soothing and help remove heat). If you take a shower, avoid running hot water directly on the treated area. A direct forceful stream of water can lead to the exudate being prematurely peeled off leading to scarring. After bathing, gently pat dry the treated area with a soft cloth. Never wipe hard with a towel. Wash your hair everyday with baby shampoo (or other non-irritating shampoo) until completely healed.

**No Hot Tubs, Jacuzzis, or Swimming Pools (with chemicals/chlorine) until redness is completely gone.**

**No Strenuous Exercise:** Minimal activity for the first 48 hours. During this time do not participate in any strenuous exercise (such as bending, squatting, straining, or heavy lifting) and avoid activities that cause

excessive perspiration. No contact sports. The less energy you use for doing things, the more energy your body will have for healing.

**Minimize Facial Expressions:** If the skin around the mouth is tight, minimize facial expressions until healed.

**No Alcoholic Beverages:** Patients should avoid alcohol for at least the first 48 hours post-op (longer is better).

**Recovery process:** The recovery process will vary from patient to patient and on the level of treatment prescribed. On average, 5 – 7 days on the face, and 7 – 10 days off face (e.g., neck, décolletage, dorsum of the hands, arms, etc.)

**Note:** Using more aggressive settings (or use of the 180 µm spot handpiece) may increase post-operative edema, erythema and recovery times from those stated above.

**Post-treatment Photos:** Photos of the treatment area should be taken before the patient leaves the office post-op and during subsequent office visits to track the progress of healing.

**Pain:** Other than a mild burning sensation for the first few hours, most patients experience no other pain. For mild pain, the patient can take acetaminophen (Tylenol or equivalent) for discomfort.

Do not take aspirin or aspirin related drugs during the healing period.

**For moderate pain relief, stronger pain medication (oral narcotic) can be prescribed if necessary (see bottom of page 14).**

**Note:** Intense pain may be a sign of infection and in such cases the patient should be seen immediately.

**Pruitis (itching):** Some patients experience a high level of itchiness for 2 – 3 days post-op. This is normally due to the release of histamines during the healing process, which can be explained to the patient as a good sign. (It could also be a sign of dry skin due to inadequate use of moisturizers).

These patients can be prescribed 1% or 2.5% hydrocortisone applied topically once or twice a day for 2 days and/or an over the counter antihistamine, e.g. Benadryl. Remind the patient that taking an oral antihistamine can cause drowsiness.

**Recommend the Long-Term Use of Anti-Aging and Collagen Promoting Skin Care Products:**

The long term use of skin care products post-treatment that promote collagen formation (which peaks during the next 3 to 6 months) will aid in skin tightening and wrinkle reduction allowing more patients to achieve their desired cosmetic goal.

**When choosing a skincare product to promote anti-aging and collagen production, some of the ingredients to look for are:**

- ✓ Alpha Hydroxy Acid (AHAs) – should be at or above 8% to be effective
- ✓ Beta Hydroxy Acid (BHAs)
- ✓ Alph-lipoic Acid
- ✓ Retinoids
- ✓ Antioxidants –
  - Green Tea
  - Pomegranate
  - French Maritime Pine Bark
  - Astaxanthin
  - Ferulic Acid
  - Prevage

- Cysteine
- Methionine
- Flavoniods
- Vitamin D3
- ✓ Kinetin
- ✓ Vitamin C - should be above 10% to be effective
- ✓ Vitamin E
- ✓ Copper Peptides
- ✓ Zinc Oxide
- ✓ Selenomethionine
- ✓ Soy-isoflavones
- ✓ Glutathione

**Return office visit:** The optimal time to have the patient return for a check-up on the healing progress varies amongst practitioners; first return visit between days 1 – 3, and second return visit between days 7 – 10. Of course any indication from the patient that they are having some sort of adverse side affect will warrant an immediate office visit. Some physicians also recommend a revisit at 3 and 6 months post-procedure.

**Remain close to the office:** Request that the patient remain within a reasonable driving distance from the office for approximately 7 – 10 days in case of any side effects.

**Possible Complications:** Have the patient call the office immediately if they have any fever, chills or pain after treatment that is not relieved by the prescribed pain medication. Also if they have excessive redness, blistering, swelling, bleeding, itching, yellow or cloudy discharge (increasing pain with deterioration in the appearance of the skin may be the first signs of infection). Failure to diagnose and promptly treat these conditions may delay healing and lead to scarring.

## What to Expect Post-Op: Risks/Possible Complications

The following is a basic summary of the most common possible complications or adverse side effects that are possible after performing ablative laser resurfacing.

**Note:** Be advised that this is by no means a complete list or thorough medical examination of post-op side effects. It is recommended that formal training in advanced ablative laser treatment and post-op care be taken from a physician with experience and training in this area.

1. **Swelling** (edema)
2. **Redness** (erythema)
  - Prolonged (persistent) or diffuse
  - Focal
3. **Hyperpigmentation**
4. **Hypopigmentation**
5. **Acne Flare-up**
6. **Milia**
7. **Keloids/Hypertrophic Scarring**
8. **Infection**
  - Bacterial
  - Fungal (yeast)
  - Viral (herpes)
9. **Ectropion**
10. **Demarcation Line**
11. **Delayed or Slow Healing**
12. **Burns/Blistering**
13. **Bleeding**
14. **Oozing/Crusting/Scabbing**
15. **Itching** (pruritis)

**16. Festoons** (not actually a side effect of laser resurfacing but visual appearance can worsen)

**17. Rash/Contact Dermatitis/Allergic Reaction**

**18. Unsatisfactory or Lack-of-Permanent Results**

**1. Swelling (edema):** a small amount of swelling is normal after any kind of skin injury (more so in areas of thinner skin such as around the eyes or on the lower neck and chest). Edema can be reduced by elevating the head while sleeping and by using ice packs. This should subside in a day or two. If greater swelling occurs the patient should notify the physician right away. A strong topical or oral corticosteroid may be prescribed.

**2. Redness (erythema):** erythema is a term used to express a medical condition, not a diagnosis. It characterizes a redness of the skin caused by dilation (engorgement) of microscopic blood vessels (capillaries) resulting in an increase of blood flow through them. This occurs due to any skin injury, infection or inflammation and may persist for 6 months or longer. After the peeling is complete, the treated area will initially be bright red which rapidly fades to a light red, to pink and then finally back to normal skin color. Patients may report an increase in itching or burning in the peeled areas.

Some patients are genetically predisposed to a longer term of erythema after injury or a pre-existing clinical disorder such as Lupus or Rosacea might predispose a patient to a stronger inflammatory response.

Inflammation is a biological response of vascular tissues to harmful or irritating substances, disease and to injury. Inflammation is an attempt by the body to remove these substances and initiate a healing process to repair injury. Without inflammation, wounds and infection would never heal. To produce inflammation, there needs to be an increase in the movement of fluid (plasma) and white blood cells (leukocytes) from superficial blood vessels (capillaries) into the injured tissue.

At the onset of injury or irritation, certain cells in tissue release inflammatory mediators which cause:

- Relaxation of the smooth muscle which surrounds arteriole blood vessels allowing more blood to flow to the superficial capillaries, the capillaries to dilate (vasodilatation) and their endothelial lining to become more permeable allowing an increase of plasma and leukocytes to pass through the capillary walls into the surrounding tissue.

Inflammation will continue until the disease, injury or irritation has ceased. The inflammatory mediators that initially get released to start the inflammatory response have a limited time to do so before breaking down. This is nature's way of ensuring that inflammation will terminate on its own unless told to continue by the release of more inflammatory mediators telling the body that the tissue is not yet healed. There are a number of diseases which are caused by the inflammatory response going out of control and not shutting down at the appropriate time leading to chronic illness. There is normally a balance between fluid leaving and fluid entering vascular spaces. Inflammation shifts this balance, causing an increase of fluid leaving the capillaries leading to a fluid build-up in the surrounding tissue.

This accumulation of interstitial fluid is called edema and is visible as swelling. Nevertheless, the plasma fluid brings important healing agents and antibodies into the inflamed tissue. In normal blood flow, the speed is such that it creates a shearing force which causes blood cells to travel in the middle of the vessels. As more and more fluid leaks out of the capillaries the blood becomes thicker (more cells / less fluid) causing congestion and reducing flow. This reduced flow rate encourages the white blood cells to stick to the sides of the vessel walls (margination). As the white blood cells crawl along the vessel periphery, they can now more easily slip between the epithelial cells lining the sides. The dilated and congested capillaries being engorged with a higher concentration of red blood cells is what gives inflamed tissue its red color.

Once the white blood cells enter the irritated, diseased or injured tissue they do 3 things:

1. Some act as phagocytes which ingest bacteria, viruses and cellular debris.
2. Some release granules which damage pathogenic invaders.
3. They release chemicals to maintain the inflammatory process.

Inflammation will cause:

- Redness – due to an increase in blood flow to the site of injury.
- Heat – from an increase of warm blood from deep inside the body to the cooler peripheral tissue. Also, increased metabolic activity from leukocyte action creates additional heat.
- Swelling – an accumulation of fluid in the injured tissue.
- Pain – due to a release of chemicals that stimulate nerve endings.

Post-operative erythema is made up of blotches that are blanched (emptied of their blood) when pushing on the skin with a finger. (This distinguishes it from red skin caused by actual bleeding into the skin which does not blanch when depressed.)

**The red color represents the effects of a combination of the following:**

- epidermal immaturity (neo-epithelium), e.g. very thin and translucent skin.
- reduced melanin absorption of light
- reduced dermal optical scattering
- increased capillary blood flow

**Prolonged Erythema:** It is normal for redness (or light pink color) to last a week or two but may last up to 3 months or more. Prolonged or persistent erythema refers to a persistent dilation of the capillaries. Erythema is more obvious in patients with lighter skin complexion and with a blushing tendency, such as those with acne rosacea. A generalized erythema in the treatment area will appear shortly after treatment in all patients undergoing laser resurfacing. Patients should be told that this is to be expected, that it is inevitable and indicates that sufficient tissue injury has occurred for the skin to mount a healing response. Any CO<sub>2</sub> laser treatment that does not induce some erythema has only produced superficial injury, and will not induce collagen remodeling. (This is the price to pay for significant cosmetic improvement.)

To cover up erythema often requires patients to use an abundant amount of makeup to hide the red tone in the skin. This can be embarrassing which patients often find objectionable when in a social setting. An alternative would be to apply a green based cover-up (concealer) worn under a patient's normal makeup to camouflage the redness which can be purchased from most cosmetic lines. This will help cancel out (neutralize) any redness that persists in the treated area. The color red and green are color opposites (on the subtractive color wheel) and will absorb or cancel each other out.

Nevertheless, intense or persistent erythema (although almost always transient, eventually clearing on its own with time once the skin has sufficiently healed) can last anywhere from weeks to months. This is not only bothersome to patients who want to return to work in the shortest amount of time, but results in multiple office visits and phone calls to the attending physician from those concerned.

The severity and length of post-op erythema will directly correlate with the aggressiveness of the laser treatment and will be worse on areas of thinner skin. Even more so when done on areas of the skin with severe actinic (sun) damage due to its thin and delicate nature.

Use of retinoids is reported to cause patchy areas of redness, edema, dryness, and scaling by more than 90% of patients during conventional tretinoin cream therapy. Thus, this pre-existing erythema (in patients using retinoids pre-op) becomes more apparent after the epidermis exfoliates. Also, post-operative use of tretinoin when applied to newly healed or thin /fragile skin will exacerbate any existing erythema.

**Note:** For this reason use of retinoids on any light skinned patients with existing telangiectasia is contraindicated.

**Risk of prolonged erythema is increased:**

- ✓ **pre-operatively by:**
  - Prior use of retinoids
  - Active rosacea

✓ **intra-operatively by:**

- multiple passes
- inadvertent pulse stacking
- excessive overlapping
- overly aggressive parameters such as –
  - higher power
  - longer pulse width
  - increased density
  - or a combination

✓ **post-operatively by:**

- infection
- mechanical trauma (excessive scrubbing of the treatment area while washing)
- scratching which causes the release of chemical trigger substances that signal the immune system to worsen the inflammation by releasing more inflammatory mediators (which in turn increases the desire to scratch more, etc. which sets up the 'itch-scratch cycle')
- increased or excessive use of soaps or cleansers for washing
- spicy foods which contain:
  - white & black pepper
  - paprika
  - red pepper
  - cayenne
- sun exposure
- systemic allergic reaction to –
  - oral antibiotic
  - other oral medication
- contact dermatitis caused by a reaction to –
  - topical moisturizer or other skin care product
  - skin cleanser
  - sunscreen
  - makeup
  - reapplication of tretinoin
- alcohol consumption

**Note:** If the erythema is being caused (or aggravated) by an irritant or allergic reaction to a substance, it's imperative that the agent be found and its use discontinued.

Also, the advantages of using tretinoin pre- and post-op need to be weighed against the disadvantages of greater or prolonged erythema!

Post-laser resurfacing erythema can be divided into 2 groups (diffuse & focal), the group being largely dependent on the degree of tissue damage inflicted by the laser; diffuse – mild to moderate damage, focal - more severe damage.

**2.A. Diffuse Erythema:** defined as mild skin redness that is spread over a large surface area of the body. Persistent diffuse erythema can lead to PIH (more so in dark skinned individuals). In most cases it is believed to be iatrogenic (cured by following a prescribed therapy) in which case it can be prevented if certain things are avoided both pre and post-op.

**If a patient develops persistent diffuse erythema, any of the following treatment methods can be used:**

- **Topical cream or ointment:** specifically designed to reduce inflammation.
  - **L-Ascorbic Acid** (vitamin C).
  - Low potency **topical corticosteroids** such as **2.5% hydrocortisone** or **0.25% hydrocortisone valerate (Westcort)**.

**Note:** Since cortisone destroys collagen and elastin fibers and inhibits the formation of new collagen some practitioners prefer to not use it (although these adverse side effects usually only occur after more than two or three months of use).

- **“Anti-Inflammatory Cream”** by Dermaquest™ Skin Therapy
- **“Anti-inflammatory Cream”** by Dr. Swain’s Natural Skin Care
- **“Pink Silk” Face Firming Rejuvenator** by Derma MD®
- **“Drop of Essence” Hydration Drops** by Rhonda Allison
- **“Replenix” Power of Three Cream and Serum** by Topix Pharmaceuticals, Inc.
- **“Oxygenating Foundation” breathable formula** by Oxygenetix
- **“Laserfade™” Post Laser Gel** by Hanson Medical Inc.
- **“Regenica™” Facial Rejuvenation Complex** by Histogen, Inc

An immunosuppressant or immunomodulator (normally prescribed to treat various forms of eczema) can also be prescribed for use as an anti-inflammatory or for those who wish to avoid the risk of side effects when using topical steroids.

**Note:** The immune system has a large part to play in controlling the inflammatory process. By suppressing or modulating the immune system it is possible to reduce inflammation.

- **Immunosuppressant cream: Elidel®** by Novartis; (1% pimecrolimus). Apply twice daily (short term, only until symptoms are gone).

Pimecrolimus is absorbed into the skin, where it reduces inflammation by blocking the production of inflammatory chemicals called cytokines. These are produced by white blood cells in the skin as part of the body's immune response to allergy or irritation.

- **Immunomodulator ointment: Protopic®** by Astellas Pharma Inc.; (tacrolimus; 0.03% for 2 – 15 yr old or 0.1% for 16 yr and over). Apply twice daily (short term, only until symptoms are gone); Tacrolimus ointment is absorbed into the skin where it reduces inflammation by inhibiting an enzyme (calcineurin) crucial for the multiplication of T-cells, cells that are required for activation of the immune system.

There is a potential complication with the topical use of pimecrolimus or tacrolimus which is increased risk of infection. The manufacturer advises that these agents should never be used if there is an active infection on the skin at the site of application. There is evidence that these agents may cause an increase in varicella-zoster, herpes simplex or eczema herpeticum viral infections and also that these agents are contraindicated in patients with a compromised immune system.

**Note:** A barrier function repair cream can be used for those who wish to avoid the risk of the side effects of an immunosuppressant, immunomodulator or corticosteroids.

- **Barrier Function Repair Cream:**
  - **EpiCeram®** by Ceragenix Pharmaceuticals Inc. (Ceramide based). Also used to avoid the risk of contact dermatitis from oleyl alcohol used as an emulsifier in **Elidel®**.
- **Antiproliferative drugs: . . . . .**
- **Anti-inflammatory Oral Medication: Oracea®** by CollaGenex Pharmaceuticals: (doxycycline, USP), normally used to treat rosacea. Dosage; 40 mg orally once per day. Does not change the bacterial resistance profile as with normal antibiotics.
- Ice or cold compress treatment: Applying ice or a cold water compress to a tissue injury has an anti-inflammatory effect. Cool temperatures inhibit local blood circulation, which reduces swelling in the injured tissue.
- A few substances known to have huge effect on reducing erythema:
  - Polygodium leucetomos
  - Carotenoid mix



- 48% lycopene mix
- Natural Homeopathic Anti-inflammatory Herbal and Vitamin Oral Supplements:
  - Coenzyme Q-10, 100 – 300 mg daily
  - Alpha Lipoic Acid, 300 – 600 mg daily
  - Green Tea Extract, 500 mg daily
  - Grape Seed Extract, 100 – 200 mg daily
  - Milk Thistle, 100 – 200 mg daily
  - Omega-3 Oil, 3 or more grams daily
  - Vitamin C, 1000 – 2000 mg daily
  - Vitamin E, 400 – 800 IU daily
  - Vitamin B Complex, 2 pills daily
- **Dehydration worsens inflammation:** Drink at least 6 to 8 glasses of clean water every day.

**Note:** Avoid heavy caffeine and alcohol which are natural diuretics that will dehydrate you.

- **Low Intensity Light Therapy:** used to reduce inflammation. There are various wavelengths (400 nm to 700 nm) that are shown to reduce inflammation when used at low intensity with long exposure times over numerous treatments.

Light in this range can be produced by systems utilizing:

**LED arrays –**

- GentleWaves® Skin Fitness System™ by Light BioScience®
- Luminos Renewal System model LT-110 by Luminos Systems

**Narrow Band Light lamps –**

- iClearXL by CureLight Ltd.

**Laser** (used to remove redness via the coagulation of superficial blood vessels):

- **DPSS** (diode pumped solid state): 532 nm
- **PDL** (pulsed dye laser)
  - ✓ **VBeam** by Candela: 595 nm
  - ✓ **PhotoGenica & Cynergy** by Cynosure, Inc.: 585 nm
- **Alexandrite:** 755 nm, **Diode:** 810 nm / 940 nm / 980 nm
- **Nd: YAG:** 1064 nm
- **IPL** (intense pulsed light) – broad spectrum of wavelengths

**2.B. Focal Erythema:** defined as a bright red skin color generally in a localized area or patch (especially on the mandibular angle or perioral skin), itchy, which is a sign of impending hypertrophic scarring (or keloid formation) requiring immediate action to halt this process. Usually these areas are darker red or even purple in color rather than a uniform erythema. Focal persistent erythema can also lead to delayed onset hypopigmentation (from 6 to 12 months post-op).

**If prolonged (persistent) focal erythema occurs, it is critical that anti-scarring therapies be implemented as early as possible in order to reverse or minimize scarring such as those listed below:**

- Ultra-potent topical steroid creams applied twice daily (if used for 10 – 14 days it usually make this subside and prevent scarring if one acts early enough).
- Intralesional steroids
- Anit-proliferative drugs

**3. Hyperpigmentation:** Also refer to the “PIH” explanation earlier in this document (pages 4-13).

If PIH occurs post-op, patients should be started immediately on a topical skin whitening regimen in an attempt to eliminate it. This should be continued for 4 weeks (or longer if necessary) until the PIH is eradicated.

**Besides application of topical agents for skin whitening, there are a number of light based devices as listed below:**

**Note:** The use of any of these systems can cause PIH in and of themselves if the skin is overly injured, so proceed with caution. Keep in mind that training and experience in their use is key to a good cosmetic outcome.

**Nanosecond Pulsed Lasers** (more effective):

- **Pulsed Dye** (504 - 510 nm)
- **QS KTP** (532 nm)
- **QS-Ruby** (694 nm)
- **QS Alexandrite** (755 nm)
- **QS ND: YAG** (1064 nm) – **most effective!**

**Millisecond Pulsed Lasers** (less effective):

- **Copper Bromide** (511 nm)
- **LP KTP** (532 nm)
- **LP Ruby** (694 nm)
- **LP Alexandrite** (755 nm)
- **LP Diode** (800, 810, 940 or 980 nm)
- **LP Nd:YAG** (1064 nm)

**IPL** (400 – 1200 nm): **least effective!**

**4. Hypopigmentation (post-treatment skin lightening):** Hypopigmentation after laser resurfacing (or after dermabrasion or aggressive chemical peels) results from excessive trauma to the skin (by using overly aggressive settings for the particular area of tissue treated). This is commonly characterized by focal persistent post-treatment erythema in the treated area. Unlike hyperpigmentation which is generally transient, hypopigmentation is often times permanent. It can develop as soon as 3 months after treatment (called early-onset hypopigmentation), but in most cases it appears between 4 to 6 months post-op and can be delayed from happening for 6 to 8 months or even up to a year after treatment (in which case it's called delayed-onset hypopigmentation). Often, the delayed hypopigmentation occurs after a period of time in which the skin appears normal. Hypopigmentation can spontaneously go away with an average duration of 3.5 months but can also be permanent or semi-permanent (going away only after aggressive treatment).

The exact causes of hypopigmentation are not known and there are a number of differing views (researchers continue to study this area) which vary from the melanocytes being completely destroyed, just being knocked into a condition where they stop producing melanin inhibiting melanogenesis, or being blocked by a thin layer of dermal fibrosis. If wounded skin isn't allowed to heal properly or there is excessive inflammation, melanocytes may temporarily (or in severe cases permanently) lose their ability to produce melanin. Also, a resulting fibrosis formation (a type of scar tissue sometimes called "dermal sclerosis") may block the melanocytes from reaching the surface. In these instances histologic images show melanocytes still present in the hypopigmented skin, but residing in sclerotic regions penetrating from 100 to 400 microns below the skin's surface. If this is the case, the only way to cure hypopigmentation is to remove the dermal sclerosis by dermasanding, chemical peels or repeated treatments of ablative laser resurfacing that get deep enough to remove this scar tissue.

According to one researcher, this laser-induced dermal fibrosis creates opacification in the papillary dermis due to the following explanation; the result of ablative CO<sub>2</sub> laser treatment is the tightening of skin as new collagen is formed and existing collagen is reorganized. These new collagen bundles (as they mature and become more organized), get tighter than they were originally. This newly created dermal fibrosis results in the loss of luminescence as the new skin's light reflectance gets altered making the dermis becomes more opaque and consequently appear paler (more hypopigmented). This is exasperated in patients with lighter skin due to the

paucity of melanin in the epidermis making it appear more translucent (and hence less so in darker skinned patients with a less transparent epidermis). In addition, the greater and deeper the dermal ablative damage (such as in patients treated more aggressively for acne scarring and deeper rhytides), the denser the post-healing fibrosis is making the skin appear even more hypopigmented. This is true for all ablative resurfacing lasers (regardless of their wavelength) and hence is not exclusive to the CO<sub>2</sub> laser.

The question also arises as to whether the hypopigmentation seen in laser resurfacing is a true hypopigmentation from the laser treatment of pseudohypopigmentation (new lighter fresh skin returned to its original color) in contrast to the sun damaged surrounding skin.

Although the risk is very rare from being caused by doing fractional resurfacing, hypopigmentation can occasional occur when overly aggressive settings are used that result in the deposition of too much heat or too deep of ablation in a specific area of tissue (at higher parameters than that which causes hyperpigmentation). This is more likely to occur with high treatment density and/or in areas of thinner skin.

The two main types of treatment to restore normal skin color consists of either trying to kick-start existing dormant melanocytes into producing melanin again or by getting peripheral melanocytes (or melanin pigment) to migrate into the damaged area.

There is little scientific evidence examining the repigmentation process and the mechanism is not fully understood. Repigmenting hypopigmented skin has proven difficult with most procedures. Nevertheless, it is strongly believed that the different treatment options are used to try to do one or more of the following:

- Any damaged or malfunctioning melanocytes that may be left in the lesion area if depigmentation is not complete (that maybe temporarily stunned into not producing melanin) might be able to be stimulated to start producing melanin again.
- Attempt to promote melanocyte migration from healthy tissue in the peripheral area adjacent to the hypopigmented site.
- Residual immature (non-melanin producing) melanocytes at the lesion boundaries start producing melanin which then spreads into the lesion area.
- Lesion area melanocytes that reside in hair follicles (follicular melanocytes) migrate up into the epidermis and start producing melanin.
- Stores of residual immature (non-melanin producing) melanocytes that reside in the lesion area to start producing melanin.

Hence, the repigmentation process can be summarized by three mechanisms:

- Proliferation of melanocytes
- Migration of melanocytes
- Enhanced enzymatic activity for biosynthesis of melanin

**Note:** As strange as it may sound, even though overly aggressive CO<sub>2</sub> ablative fractional resurfacing may have been the cause of the hypopigmentation, doing 3-4 repeat treatments of fractionated CO<sub>2</sub> laser may be help repigment the skin by allowing some migration of melanocytes and melanin pigment from the underlying hair follicles. CO<sub>2</sub> fractional laser by itself has been shown to significantly improve hypopigmentation of acne and surgical scars (75% improvement at eight-week intervals). See study below.

J Drugs Dermatol. 2010 Nov;9(11):1420-6.

**Treatment of CO<sub>2</sub> laser induced hypopigmentation with ablative fractionated laser resurfacing: case report and review of the literature.**

Tierney EP, Hanke CW. Source; Tufts University School of Medicine, Boston, MA 02111.  
PMID: 21061766 [PubMed - indexed for MEDLINE].

Hypopigmented scars are felt by some to be caused by a thin sheet of scar tissue that sits like a plate in the upper levels of the skin. As a result the cells that make color (melanocytes) have a hard time getting back to the area to color the skin like the same that it was before the trauma.

By poking microscopic holes in this thin layer (sheet) of scar tissue with a fractionated laser (or dermal microneedling), some feel that the cells can migrate back in and begin to repopulate the area.

Non-ablative fractional resurfacing (1550 nm Fraxel re:store) have also been shown to improve hypopigmentation.

Topical therapies such as Retin-A and Elidel (or Protopic) have been mildly successful because they each increase melanocyte mobility.

Topical medications, such as hydroquinone, TriLuma, and other skin lightening agents may be used to bleach peripheral tissue not affected by hypopigmentation so that it can blend in better with the hypopigmented skin.

### **Non-Light Based Treatment Options:**

- **Attempts at Cover-up**
  - ✓ Camouflage with makeup
  - ✓ Tattoo using natural skin tones
- **Surgical excision (for small areas)**
- **Autologous skin grafts or "minipunch" skin transfer for large areas**
- **Autologous melanocyte transplant** (experimental)
- **ReCell®** by Avita Medical (autologous cell harvesting ReCell enables the delivery of keratinocytes, melanocytes, fibroblasts and Langerhans cells harvested from the epidermal-dermal junction for application onto a wound surface in order to promote rapid and effective healing)
- **Vitilgo Tab™ pills** by Musaffeen International
- **Pigmentum™ pills** by Pigmentum Inc.
- **Chemical peels and/or dermabrasion (Er: YAG laser peels)**
- **Series of vitamin A & glycolic acid peels followed by laser-assisted chemabrasion**
- **Topical Corticosteroids** (Clobetasol Propionate)
  - ✓ Alone or in combination with vitamin D3 analogues (modulates epidermal proliferation and differentiation and inhibits immune induction) and calcineurin inhibitors (cyclosporine, pimecrolimus or tacrolimus)
- **Topical creams or ointments** (used with or without corticosteroids)
  - ✓ **Novitil®** by DermaBest®
  - ✓ **V-Tar** by Dermasave labs, Inc.
  - ✓ **Pseudocatalase Cream** (PC-KUS)
  - ✓ **L-phenylalanine**
  - ✓ **Anti-leucoderma™ Oil** by Cure Herbals
  - ✓ **Protopic®** (Tacrolimus Ointment) by Astellas Pharma Inc.
  - ✓ **DermaTint** by TrueHerbals
  - ✓ **Antioxidants**
  - ✓ **Ginger root juice**
    - The juice from a fresh sliced ginger root placed on the skin has been known to repigment skin (the ginger root has some type of property that tells the surrounding healthy skin cells to teach the neighboring discolored cells how to start producing melanin again). The ginger root slices can be applied several times a day. When the slice dries out, cut another slice and apply.

### **Light-Based Treatment Options:**

- **UVA + Psorelan (PUVA / PUVASOL):** 320 – 400 nm (with 8-MOP or TMP)
- **Broadband UV (B-UVB):** 290 – 320 nm
- **Narrowband UV (NB-UVB):** 305 – 311 nm alone or with topical calcineurin inhibitors (cyclosporine, pimecrolimus and tacrolimus)
- **XeCl Excimer Laser:** 308 nm
- **XeCl Excimer Laser:** 308 nm + topical 0.1% tacrolimus ointment

**Using Latisse® to Treat Hypopigmentation:** A first study of its kind (of 5 patients with long-standing partial facial or scar hypopigmentation) was conducted by Richard Fitzpatrick, MD (presented at ASLMS in April, 2010) titled **“REPIGMENTATION OF HYPOPIGMENTED SCARS,”** showed that an off-label use of Latisse® (0.03 % bimatoprost ophthalmic solution manufactured by Allergan, Inc.) in combination with other therapies (as described below), yields promising results in the repigmentation of hypopigmented scars because it increases the production of pigment rather than increasing cell division. What led to this line of thinking was that it was found that Latisse® not only darkened the eyelashes but also often darkened the surrounding skin, so why not the darkening of hypopigmented skin as well. Dr. Fitzpatrick stated, ‘The reason for a combination approach is that the laser and topical treatments allow for better penetration of the bimatoprost.’

Latisse Combination Therapy for Hypopigmentation: 1 – 4 sessions of Fraxel re:store (1550 nm) at 4 – 8 week intervals followed immediately afterwards with:

- Bimatoprost 0.03% ophthalmic solution
  - ✓ Dosed at one drop per cm<sup>2</sup>
  - ✓ Applied b.i.d. (twice daily) for 4 months
- Topical application of Retin-A cream 0.025% q.h.s. (every night before bedtime)

Dr. Fitzpatrick noted as a follow up at the end of the 6 month study, “All five patients uniformly demonstrated clinically significant repigmentation, and they responded almost immediately.” He stated that the study’s limitations did not allow for evaluation over longer periods of time. However, in follow-up evaluations with his own patients, he found that the results were maintained for long durations, with one patient’s results lasting approximately three years. Moreover, bimatoprost is associated with a benign pharmaceutical effect, indicating a level of safety as well. And it has been found that there has not been an associated hyperpigmentation of the skin surrounding the treated area of hypopigmentation.

Also, Dr. Fitzpatrick later said, “Recently I have been treating patients who present with pigment loss on the face, cheek, neck and nose with a combination of a non-ablative fractional laser that helps with melanocyte migration, Latisse®, and a retinoid.”... “I have had up to 70% improvement in the appearance of hypopigmentation, and my patients are really happy because previously nothing worked for them. This regimen however, hasn’t seemed to work as well for linear hypopigmented lesions.”

**Note:** There are those who are afraid of using Latisse® anywhere except on a man’s face, for fear that it may also stimulate hair growth. Dr. Fitzpatrick also addressed this question concerning whether or not bimatoprost would encourage hair growth in the scarred/treated area, “If it is being used on true scar tissue, then the question of hair growth is of minimal concern because true scar tissue does not have hair follicles.” Nevertheless, possible hair growth is something to consider when using this combination treatment.

A few months later a study done on 10 patients titled **“Efficacy and Safety of Topical Bimatoprost Solution 0.03% in Stable Vitiligo: A preliminary Study”** (August, 2010) was conducted Dr. Tarun Narand of Gian Sagar Medical College, Banur, India to see if Latisse® (dosed at one drop per cm<sup>2</sup> applied twice daily for four months) would help repigment hypopigmented skin in patients with localized Vitiligo. Results showed that 7 out of 10 patients demonstrated pronounced repigmentation beginning on average after 2 months of treatment. At the four-month follow-up, 3 (of these 7 patients) had a 100% repigmentation, 3 had 75-99% repigmentation, and 1 patient showed a 50-75% repigmentation of the treated lesions.

**Note:** Latisse® can also be used in conjunction with dermarolling or dermal needling which will enhance its absorption. You do not need to needle deeply as the melanocytes reside at the bottom of the epidermis, which is very shallow. Before you apply bimatoprost to scars or stretch marks, you should attempt to smooth out the texture of the tissue as much as you can by repeated dermarolling or needling. This will crush the hardened bundles of collagen and greatly improve its texture. Needling or dermarolling also triggers the formation of new blood vessels (scars and stretch marks have no or almost no blood vessels) which is very important for normal skin appearance and functioning. What will be really difficult is to apply bimatoprost precisely to the area to be treated without getting in on the surrounding tissue as this might cause it to darken. Perhaps a toothpick could be used for precise application.

There are reports by clinicians who claim that they have achieved completed and permanent re-pigmentation of hypopigmentation by a series of dermal needling or dermarolling treatments alone without applying

bimatoprost or anything else. They believe that dermal needling triggers or “wakes up” the melanocytes to again start producing melanin.

Yet another study was conducted a couple of years later in 2012 by “Massaki AB, Fabi SG, & Fitzpatrick R., titled “**Repigmentation of hypopigmented scars using an erbium-doped 1,550-nm fractionated laser and topical bimatoprost.**” *Dermatol Surg.* 2012;38:995-1001.

This time there were fourteen patients with hypopigmented scarring who were again treated with a fractionated 1550-nm erbium doped laser using the same protocol as before except that topical application of Retin-A was replaced with tretinoin 0.05% or pimecrolimus 1%. Again, most patients demonstrated significant improvement in their hypopigmentation.

Although all three of these studies were done using a non-ablative 1550 nm fractionated laser, there have also been reports of physicians using ablative fractional CO<sub>2</sub> lasers using the same or similar protocol with equally impressive results.

A study just completed (Jul-Aug, 2015), was done using an ablative fractional CO<sub>2</sub> laser though using topical latanoprost (rather than bimatoprost but being a very similar drug) reporting similar results as the three previous studies. See below:

**Repigmentation of Hypopigmented Scars Using Combination of Fractionated Carbon Dioxide Laser with Topical Latanoprost Vs. Fractionated Carbon Dioxide Laser Alone.** *Indian J Dermatol.* 2015 Jul-Aug; 60(4): 364–368. doi: 10.4103/0019-5154.160481

28 patients with hypopigmented scars were enrolled in the study. Patients were treated with 6 sessions (1 month interval) of CO<sub>2</sub> fractionated laser in combination with topical application of latanoprost ophthalmic solution 0.005% (dosage of one drop per 2 cm<sup>2</sup> area, twice daily for 6 months). The authors noted:

- Most patients had marked clinical improvement in their hypopigmented scars
- The longer the interval between scar initiation and treatment, the lower the probability of cure
- No hypertrichosis was observed throughout the follow-up period
- No long term side effects

**5. Acne Flare-up:** Generally caused by a build-up of bacteria trapped underneath very occlusive moisturizers used after laser resurfacing. This is more common in patients with a history of acne breakouts. If acne occurs, discontinue use of the existing ointment and switch to something less occlusive. Often times a 2 – 3 month course of oral antibiotics will be necessary. Topical antibiotics and/or retinoids might also be helpful.

**6. Milia:** Milia (plural for singular word milium) are little white bumps on the surface of the skin which sometimes appear 2 to 4 weeks after skin resurfacing. They are painless, don’t cause any harm, but are unsightly. During the skin’s normal exfoliation process, keratinocytes (skin cells) die and then are slowly shed (sloughed off). Keratinocytes are full of keratin (protein which gives the bumps their white/yellowish color). When very occlusive (petrolatum or oil based) moisturizers are used after laser resurfacing, often times the skin’s pores (ducts leading to the skin surface from hair follicles) get clogged, thus leading to a build-up of fluid (sebum & keratin) and debris (dead skin cells) causing small dome shaped cysts.

Although with proper knowhow they can be removed at home (with topical cortisone cream, exfoliating scrubs or peels, or dermal extraction), they are best treated by the attending physician where they can be easily unroofed with an 18 gauge needle and extracted using pinpoint electrodesiccation. Sometimes they will eventually clear on their own once the occlusive moisturizer is discontinued.

**7. Keloids/Hypertrophic Scarring:** Scarring represents the worst complication although luckily it is the least likely side effect to occur. Although the risk of scarring is very low it can occur any time the skin is broken. The earliest signs of impending scar formation is persistent erythema and delayed healing. The areas around the mandible and over the bony prominences of the malar area as well as the perioral areas are the most commonly affected.

There is higher risk with:

- Increased depth of resurfacing
- Poor post-op wound care
- Out-of-control infection
  - ✓ Bacterial
  - ✓ Viral
  - ✓ Fungal
- Prolonged or intense erythema
- Recently taking Accutane
- History of keloid or hypertrophic scar formation after tissue injury
- Previous face or neck lift

**Note:** Face and neck lift procedures produce a subtle fibrosis which interrupts the continuity of the normal cutaneous vasculature. This limits the skin's wound healing capacity by positioning underprivileged neck skin onto facial sites (to a position above the jawline). It is thus important that during the patient consultation the treating clinician acquires a thorough history of any past plastic surgical procedures.

Most significant factors:

- Depth of tissue ablation
- Treatment density
- Number of passes
- Excessive overlap
- Lower number and/or density of adnexae (skin's appendages i.e. pilosebaceous units and sweat glands)

Types of scars created:

- Hypopigmented flat scars with a shiny surface
- Thickened and elevated hypertrophic scars
- Depressed atrophic scars with sharply defined borders

Until proven otherwise, any "localized persistent erythema" should be considered as a possible hypertrophic scar. Once scarring begins to develop aggressive action is indicated as early intervention will have a greater impact on reducing or elimination scar formation that later on. Recommended management of potential scarring should be aggressive and include one or more of the following regimens: high potency class 1 topical steroid (e.g. clobetasol propionate 0.05%) applied twice daily, intralesional steroids e.g. Kenalog 10% (triamcinolone acetonide 10 mg/ml) at 4 week intervals (in some cases higher concentrations up to 40% may be needed), or silicone gel sheeting. If a scar forms, massage and compression can help reduce the collagen deposition and cross-linking of fibrotic tissue.

Usually early forming scars will respond quickly, often in a week or less, but it may take up to 3 or 4 weeks for the scarring to completely resolve. If high potency steroids are used for more than a week or two it may lead to some skin atrophy and telangiectasia formation, but these side effects may be acceptable in the face of additional scarring.

IPL or 585 nm flashlamp pumped dye laser can be used to help remove redness and flatten scars after forming. These treatments can be done every 6 to 8 weeks apart if necessary with up to a 50% improvement. Non-ablative fractional lasers, dermal microneedling, as well as additional CO<sub>2</sub> ablative resurfacing can also help breakup the scarred tissue over a number of treatments.

**8. Infection:** Post-op infection is rare but may include **bacterial**, **viral** (herpes simplex or herpes zoster), **or fungal** (yeast). Since at times it is difficult to determine what type of infection is present, for these patients they should be treated with two types of oral antibiotics and anti-viral agents until the culture results become available.

- **Bacterial (refer to pages 13 & 14):** It is very important to culture any post-op infection in order to prescribe the correct antibiotic. Nevertheless, it is wise to consider all infections as possible methicillin-resistant staphylococcus aureus (MRSA) infections until proven otherwise. Bacterial infection after laser resurfacing is usually pseudomonas and can usually be recognized as adherent yellow exudate/crusting (may be malodorous), pustules, or by increased pain, swelling and delayed wound healing, and accompanied by some fever. They often begin to appear 48-96 hours after the procedure.
- **Viral/Herpes (refer to pages 11 & 12):** Unusual or unexpected pain (often intense) and itchy/stingy prominent red rash (often including superficial skin ulcerations) usually manifesting within 4 – 5 days of treatment may reflect the onset of a viral infection! Can cause a long delay in healing and lead to scarring if not treated early on! This infection may disseminate over the entire face if not immediately treated and produce lesions which can lead to scarring!

Herpetic infection can occur after laser resurfacing in up to 50% of patients with a known history of herpetic infection if no prophylaxis is given and up to 10% in all patients.

In patients who get a herpes infection post-operatively (whether they were or were not undergoing prophylactic antiviral therapy), treatment should be undertaken immediately with an anti-viral medication dosage usually at twice the strength used for prophylaxis (increased to the maximum herpes zoster dose):

- famciclovir (**Famvir**), 500 mg PO, 3 times daily.
- acyclovir (**Zovirax**), 800 mg PO, 5 times daily.
- valacyclovir (**Valtrex**), 500 PO, 3 times daily.

An anti-viral ointment can also be added if the patient develops a viral prodrome post-treatment.

**Note:** If someone is already taking oral valacyclovir and still comes down with a viral infection culture positive for herpes simplex), it will be necessary to put them on an intravenous anti-viral medication (i.e. intravenous acyclovir). A patient can also be exposed to HSV for the first time during the healing period and may become infected with primary inoculation herpes, experiencing lymphadenopathy, fever, and severe pain. These patients can also be treated with intravenous anti-viral medication.

The primary concern of a viral infection is the possibility of scarring during the healing process. Fortunately, although these outbreaks are quite uncomfortable and appear severe, the incidence of scarring is low.

- **Fungal/Yeast Infection (refer also to page 12):** Usually caused by candida (yeast). Fungal infections may be subtle and only promote increased or prolonged erythema or itching, which can be confused with contact dermatitis, acne or milia formation. There may also be increased swelling and crusting as well as occasional vesicles or pustules. The most significant manifestation may be delayed re-epithelialization.

If the patient was already started on anti-fungal medication shortly after surgery and nevertheless contracts a yeast infection, it should be treated with an increase in dosage of fluconazole (Diflucan), 150 – 200 mg daily for 5 – 7 days (or higher dosage if desired), along with the initiation of an anti-yeast cream as soon as the fungal infection is recognized. Once on medication, the infection most often will clear in approximately 2 weeks. Acetic-acid soaks may also be helpful.

**9. Ectropion:** Sometimes when doing aggressive CO<sub>2</sub> ablative resurfacing on the lower eyelids in patients with very lax skin, the thermal shrinkage of the skin caused by the laser light can overcome the skins natural resistance which holds it in place up against the eyes causing it to turn outward causing ectropion. If some retraction of the lower eyelid skin begins to develop after resurfacing, massage, eyelid taping, or topical or intralesional steroids can be used. In worse cases a surgical procedure to tighten up lower eyelid skin (called a Canthoplexy) can be performed to prevent Ectropion from occurring.



**10. Demarcation Line:** Although rare, a demarcation line may appear between treated and non-treated areas or between very aggressively and mildly aggressively treated regions. Feathering or blending of the transition zone between these areas using lower parameters will lower the risk of demarcation line formation.

**11. Delayed or Slow Healing:** Rare but may occur in patients who have previously damaged skin from a chemical peel, dermabrasion, burns, electrolysis, and radiation therapy or from some underlying disease. The more aggressive the treatment, the longer the post-op healing time. Be patient!

**12. Burns/Blistering:** The injury produced by Fractional CO<sub>2</sub> resurfacing is similar to mild superficial sunburn which normally heals up without incident. Although very rare, blistering can occur if excessive heat is deposited during treatment and appropriate aftercare is not followed. Proper cooling of the treated area immediately post-op and keeping the area moist over the next few days is very important or blistering can occur soon afterwards or even hours later. If blisters do show up, be careful not to pop or scratch them. Let them heal up on their own. It's very important to keep the area clean. When the blisters scab over, do not pick at the scabs, they will fall off when they are completely healed. Patient should contact the office immediately if the site becomes infected. A presence of a honey colored oozing or a spreading redness will indicate an infection. Depending on the degree of blistering and body location, the skin might or might not scar.

**13. Bleeding:** Small amount of pinpoint bleeding (petechiae) may occur in some patients. This is normal. This will be more prevalent in patients with thin skin, in patients with an increased underlying vascularity in the treatment area (i.e., patients with a history of severe facial acne) or when more aggressive treatment parameters are used resulting in deeper tissue ablation.

**14. Oozing/Crusting/Scabbing:** Some oozing is normal. Oozing will form a crust as part of the normal healing process usually within 24 to 48 hours. This crust will eventually peel off over 5 to 7 days for facial treatments (or longer depending on aggressiveness of treatment or in other body locations). In very thick skinned individuals or when performing mild treatments oozing and subsequent crusting might not occur at all.

**15. Itching (Pruitis):** Though rare a small amount of itching may occur in some patients. This is usually a sign of normal wound healing or could be a sign of excessively dry skin (in which case use of a moisturizer should be increased). Antihistamine OTC or low potency topical corticosteroid may be used short term to alleviate symptoms. If persistent or severe itching occurs this could be a sign of an impending infection, contact dermatitis or an early sign of scarring. Patient should seek immediate medical attention.

**16. Festoons:** Festoons (or malar mounds) are soft puffy fat filled (and sometimes also fluid filled) areas of excess lax sagging skin that appear (protrude) on the upper cheekbone below the lower eyelids in the malar region (area below the edge of the bone that forms the eye socket). They are the result of fat that migrates forward below the eyes due to weakening of the underlying tissue structure and muscles. This weakening is believed to be mainly caused by stress in the overlying skin due to underlying muscle-forces. This, along with many years of sun exposure and aging allows the elastic fibers in the skin to undergo subtle but progressive damage. Also, it can be aggravated by an accumulation of fluid due to hot, humid weather. There is some evidence to support the belief that hormone levels and the consumption of salty foods can also cause festoons

Festoons can make us look tired, ill or like we have severe allergies or the flu. Festoons are much less common than lower lid fat bags, occur primarily in people of lighter skin types, may be present to a minor degree at an early age, but increase in severity over time as one grows older.

**A face-lift will not correct it and although a lower lid blepharoplasty and/or fractional resurfacing can rejuvenate the area directly beneath the eyes, this unfortunately does not remove or improve the festoon itself.** The best treatment depends upon the size of the festoon and whether it is due to fat, excess skin, or combination. Because surgical excision of the festoons often results in unacceptable scars and other common treatments are temporary or unsuccessful (some festoons respond to steroid injections), a different type of treatment is warranted. **If mostly due to excess skin, ablative CO<sub>2</sub> fractional resurfacing is generally recommended (although in severe cases surgery might be required to remove the excess skin that cannot be tightened satisfactorily with a laser).** Fractional laser resurfacing in the immediate

**area regenerates dermal collagen which will flatten out the festoons over time, lessening their appearance over the next few months.**

Although fractional laser resurfacing does not cause festoon formation it is possible that after fractional resurfacing under the eyes (similar thing happens after lower eyelid blepharoplasty) the festoons can actually look worse and more noticeable (often the patient will notice them for the first time making the patient think that the previous treatment actually created the festoons). This is due to the fact that once the fullness of the lower eyelid is removed above the festoon, the problematic puffy area is highlighted making the festoon more obvious. Although fractional CO<sub>2</sub> laser resurfacing should not exacerbate any existing festoons there could be some residual lymph edema of the orbicularis muscle in the malar region due to slight tissue trauma from the resurfacing treatment. This excess edema will eventually go away on its own, but digital massage from medial to lateral each morning by the patient can reduce the swelling.

Festoons can be treated as a sole procedure or in addition to full face fractional laser resurfacing although most patients would also benefit from lower eyelid blepharoplasty as the aging process effects the entire area. Transconjunctival blepharoplasty of the lower lids is the preferred method as it does not leave a visible scar and is safer in terms of not pulling down the lower lids. The CO<sub>2</sub> laser which cauterizes as it cuts (rather than a cold steel scalpel blade) has revolutionized blepharoplasty as the surgery can be performed in much less time with no bleeding! When doing upper and lower lids on both eyes, total blood loss can be measured in a single Q Tip. Less bleeding results in faster healing, less bruising and less pain. The laser, unlike a scalpel can also shrink/tighten tissue and ablate fat around the eye. Once physicians use a laser for performing blepharoplasty, they won't revert back to a scalpel.

**17. Rash/Contact Dermatitis/Allergic Reaction:** Rare but may occur due to an irritating reaction of the skin (especially to newly resurfaced skin without its normal protective covering), to an ingredient in the post-op topical moisturizer (gel, cream, or ointment), cleanser, or topical antibiotic (if used). As a practitioner it can be particularly challenging to distinguish between contact dermatitis and an infection while the patient's skin is red and edematous. Also, it doesn't help when most patients don't provide an adequate history of sensitivity to any particular agent during the consult which thus offers few clues to the source of the problem.

It typically develops later than an infection typically beginning about 7-10 days post-op and is associated with intense pruritis that extends beyond the treated area along with possible copious amounts of exudate and crusting. When patients present with an inflammatory reaction, they should be questioned about what topical agents they may be applying on their own and urged to discontinue these when appropriate. Initially try switching to a different moisturizer (one that is hypoallergenic with few active ingredients) in an attempt to remove the irritant.

Cool, wet compresses may help to alleviate the symptoms. Treat with a mild topical steroid and/or an oral antihistamine. A high potency corticosteroid (topical or oral) may be necessary to prevent scarring if this conditions worsens.

**19. Unsatisfactory/Recurrent (or Lack of Permanent) Results:** As in any surgical procedure optimal results cannot be guaranteed. Results will vary according to patient age, skin condition, skin type, treatment area, aggressiveness of treatment, underlying disease, previous cosmetic procedures, patient adherence to after-care instructions, physician skill, etc. Dynamic wrinkles (wrinkles caused by muscular action) are very persistent and are likely to remain or reoccur. Although one treatment is usually all that is necessary to achieve optimal results, deep wrinkles or scarring may require additional treatments.

## Ablative Laser Resurfacing Contraindications

The following list of contraindications is by no means complete but includes those generally used by the medical community. Some contraindications are of **relative** importance (may or may not cause a problem) and some are **absolute** (very likely or for sure to cause a problem). Careful consideration of each contraindication should be undertaken prior to treatment. The decision to continue with treatment despite a patient having any particular contraindication is a medical decision each practitioner will need to make for themselves based on training and sound medical judgment.

- unrealistic expectations
- non-compliant patient
- high blood pressure
- history of poor wound healing
- heavy smoker or extensive user of other tobacco products
- any active infection
- history of keloid formation or hypertrophic scarring
- pregnancy
- breastfeeding
- current sun burn or extensive sun exposure
- skin type V & VI
- any inflammatory skin condition
- tattoo or permanent makeup in treatment area
- history of bleeding disorders
- active acne cysts and large pustules
- auto-immune disorders, e.g., lupus, scleroderma, AIDS
- history of endocrine disorders, e.g., polycystic ovary syndrome or diabetes not under control
- epilepsy
- skin tumors
- any form of active cancer
- active herpes simplex
- prior radiation therapy in treatment area leading to a loss of adnexal structures
- currently taking anti-coagulants
- use of immunosuppressive medication
- use of oral retinoids i.e., Isotretinoin, within the last 9 to 12 months
- recent chemical peel (within the last 3 weeks)
- vitiligo
- within surgical operation recovery period
- Koebner's disease (e.g., psoriasis, eczema, etc.)
- skin atrophy from previous laser resurfacing or chemical peel
- previous transcutaneous lower blepharoplasty or those with limited infraorbital elasticity if resurfacing is to be done within the orbit