

# CHAPTER 3

## COMPLICATIONS IN LASER HAIR REMOVAL



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- Laser Effects on Tissue
- Types of Complications
  - Level of Burns
  - Burn Treatments
- Pigmentation Process
- Best Practices and Response to Complications



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# Laser Effects on Tissue

## Thermal Effects

- Laser Hair Removal
- Treatment of spider veins
- Treatment of sun damage with IPL

## Mechanical Effects

- Treatment of unwanted tattoos
- Treatment of melasma
- Breaking up a urinary stone

## Photo Ablative Effects

- LASIK

## Photodynamic Effects

- Blue light / red light therapy for acne
- Treatment of actinic keratosis



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# Prevention

- Training & Certification
- Facility requirements
- Laser maintenance
  - When something just doesn't seem right
  - Calibration
- Right tool for the job?
- Proper Intake and Pre-treatment considerations
- Post-treatment considerations
- Consent Sheets & Release from liability



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# Types of Complications

- Thermal Injury Leading to a Burn
  - First Degree Burns
  - Second Degree Burns
  - Third Degree Burns (Fourth Degree improbable)
- Erythema
- Perifollicular Edema
- Histamine Reaction
- Purpura
- Lingering discomfort and soreness
- \*Remember: Just because a client has experienced a complication does not mean that the technician did anything wrong! So relax, and let's learn how to best proceed.



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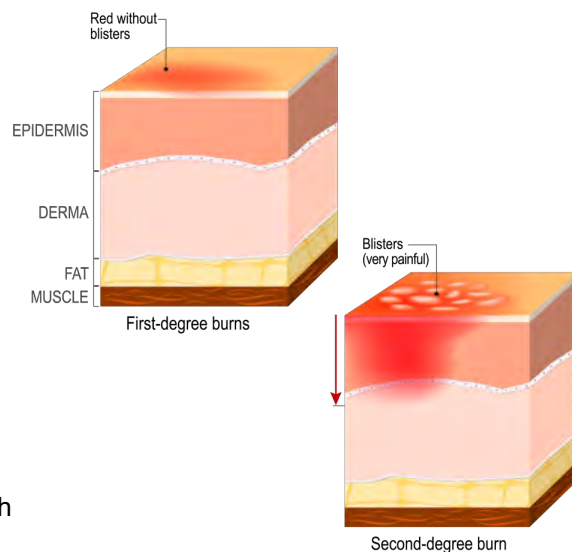
# First and Second Degree Burns

## First Degree Burns

- Thermal injury limited to the epidermal layer of the skin.
- Micro-crusting of pigmentation.
- Akin to that of a pronounced sunburn.
- No blistering.

## Second Degree Burns

- Blistering present – with thermal injury to the dermis
- Breach of epidermal barrier and increased exposure to infection.
- Superficial verses deep partial thickness – the latter with red blisters in lieu of clear blisters with increased chance of scar tissue formation.

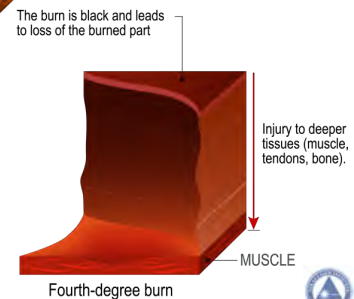
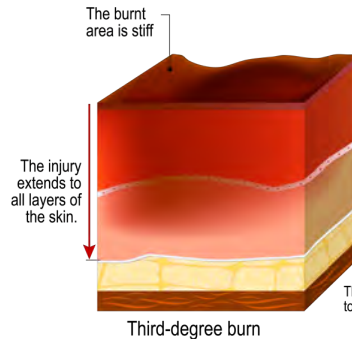


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# Third and Fourth Degree Burns

## Third Degree Burns

- Thermal injury to the hypodermis.
- Nerve endings sustain thermal injury, eliminating perception of pain.
- Very uncommon in laser hair removal due to target chromophore – melanin, not water.
- More commonly seen in tattoo removal with use of long pulse lasers.



## Fourth Degree Burns

- Thermal injury so extensive that injury extend to the underlying muscle and bone.

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# Burn – How Do You Know it's Happening During Treatment?

- You may not know right away!
- Unfortunately, a burn may take several minutes to become apparent – otherwise giving a delayed sensation due to the cooling that takes place simultaneously with treatment.
- It is normal for a client to believe the skin feels “hot” during laser and IPL treatments, but you should expect the skin to cool down quickly.
  - The key is to distinguish between melanin absorption within the skin and the absorption of energy within the hair follicle. Very tricky for your clients to portray accurately!
  - Laser hair removal should feel something like a sharp rubber band snap, without any lingering pain or heat. Residual numbing likely in context with certain treatment areas and wavelengths
- Test pulses with ample time for the skin to normalize is most prudent. But be careful to consider realistic sampling!



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## Is A Burn Forming?

- Does the client report a different sensation than previous treatments?
  - “It didn’t feel like this last time...”
  - “It hurts a lot more...”
- Does the client report a warming sensation that evolves quickly into a hot sensation, to, within minutes, develop into a “wildfire” sensation?
- If you have a burn, it’s Hot! And becoming hotter! Remember – burns burn!



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## Immediate Treatment

**Actual first aid treatment will depend on the severity of the burn, but immediate steps are:**

1. Cool the skin as quickly as possible (within the first hour) with running cold water, cold air/compress, or ice, if necessary. However, **do not** place ice directly upon the skin. Ideally, the client may be able to remain at the clinic for extended period of time.
2. Absent allergy to sulfa, application of silver sulfadiazine or other suitable ointment – Biafine, Polysporin, Aquaphor, bactrim ointment, Polysporin but NOT Neosporin.
3. Proper dressing – gauze with ointment, with additional consideration for remedies including: silicone-coated nylon dressing.
4. While driving home after the treatment, have the client aim a/c toward the treated area if possible. Continue with application of cold packs or other suitable cooling modality.
5. When at home, continue cooling until burning sensation subsides.



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## Immediate Treatment (continued)

1. Instruct client to not apply ice directly to the skin, and do not leave cold packs on the skin for an extended period . On for ten minuets, off for five minuets, as an example.
2. Do not immediately apply an occlusive ointments such as Aquaphor or Vaseline, unless necessary, as it may trap in the heat – albeit debatable.
3. It may be recommended to loosely wrap the area in gauze.
4. Follow-up first thing in the morning and see what has developed.



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## Treatment – First Degree Burns

- Like a sun burn, a first-degree burn should resolve fully without further complication.
- Avoidance of prolonged sun exposure is of paramount importance.
- No additional stimulus – avoid waxing, hot showers, towel wraps, or hot tubs/Jacuzzis.
- Sunscreen, cleanliness, hydration, lack of friction, soothing ointment are all excellent points of discussion.
- Expectations – with possible appearance for mistaken hypo-pigmentation.



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## Treatment – Second Degree Burns

- Report second degree burn to consulting physician and make determination if constitutes a reportable medical event.
- For second degree burns, consistent application of Silvadene burn cream, absent allergy to sulfa, or other suitable alternative.
- Reapply up to 4 times/day or as necessary.
- Proper cleaning & dressing are essential.
- Remain mindful for infection with immediate follow-up with physician if suspicion of infection exists.
- Risk of infection: Oral antibiotics depending upon location and extent of injury, Diabetes, HIV/AIDS.
- Considerations for first degree also incorporated.



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## After the Burns Have Scabbed Over

- The most important thing you can do is protect the area from further injury, this includes sun exposure.
  - Be sure to use an SPF 35 or higher with Zinc Oxide, but note possible exception in the event of hypo-pigmentation.
  - Address itching with moisturizers .
- You can help prevent/mitigate and treat post inflammatory hyper pigmentation (PIH) - dark skin discoloration - by using skin lightening creams/inhibitors and Tretinoin (Retin-A)/other daily exfoliation methods.
- Topical Serums that contain Vitamin C , and products with growth factors can aid in collagen production, improve skin healing and reduce inflammation.



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## Special Notes

- If the PIH from previous thermal injury has aged, consider chemical exfoliation
- If the skin is hypo-pigmented (loss of pigment), then you can apply UVB light to just the affected areas in effort to create a tanning response
- Be mindful that crusting is not PIH and should therefore not be treated the same.
- Correcting skin discoloration is a process and it can take many, many months
- Absent post secondary infection, pronounced scar tissue is not very likely to form from a thermal injury in context of laser hair removal.
- Some of the easiest remedies are the best and are usually first forgotten
  - Again, Remember to apply cooling!
  - Remember to keep the area elevated!
- Areas that first appear as though they've healed nicely or have formed hypo-pigmentation may begin to form PIH several weeks post treatment
  - Do not immediately tan hypo-pigmentation for fear that PIH may soon develop
  - Do not expose areas affected with PIH to prolonged sun exposure as they will become more pronounced!



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## Regaining Pigmentation - Understanding The Process

- To best treat skin complications as well as determine the most appropriate laser settings, a thorough understanding of the skin and production of melanin is essential!
- Just remember, the skin is an amazing organ. And when the thermal injury is isolated and limited – the sort caused by laser hair removal – cellular memory is also limited with re-pigmentation/correction of pigmentation to be expected.



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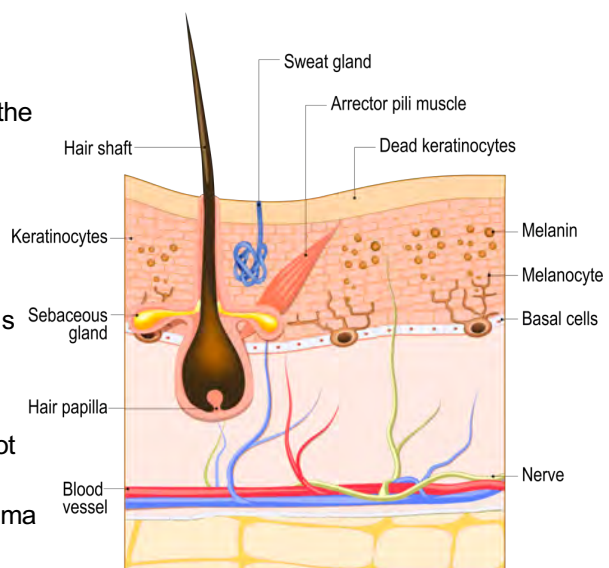
# Skin Is An Amazing Organ!



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## Pigmentation I

- Melanocytes are melanin producing cells located in the bottom layer of the skin's epidermis.
- Melanin is the pigment primarily responsible for skin color.
- Melanin is also the target chromophore in laser hair removal.
- If the thermal relaxation time between hair and skin is not properly balanced, thermal injury to skin may result.
- Melanin composition is more superficial in darker skinned individuals. Thermal injury may therefore not be as deep!
- Darker individuals can be trickier to predict post-trauma response.



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## Pigmentation II

- Complexions are classified into six skin types (known as the Fitzpatrick Scale) – with one's propensity to tan acting as a much more accurate indicator to his/her true skin type than apparent skin type.
- Skin type is not stagnant – with melanin density able to alter with age. Genetic defects, exposure to ultraviolet light, diseases, and/or trauma to the skin can all play a factor.



**Type I**

Light,  
pale white

Always burns,  
never tans



**Type II**

White,  
fair

Usually burns, tans  
with difficulty



**Type III**

Medium,  
white to olive

Sometimes mild  
burn, gradually  
tans to olive



**Type IV**

Olive,  
moderate brown

Rarely burns, tans  
with ease to a  
moderate brown



**Type V**

Brown,  
dark brown

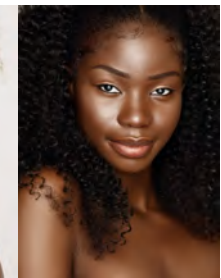
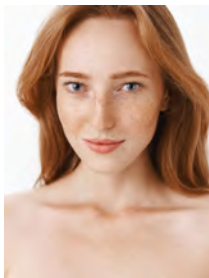
Very rarely burns,  
tans very easily



**Type VI**

Black, very dark  
brown to black

Never burns, tans  
very easily, deeply  
pigmented



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## Hyperpigmentation I

Must be able to distinguish different types of hyperpigmentation – as not only are they treated uniquely, but also have different root causes.

### ► Sun Damage

- Continual exposure to the sun and ultraviolet rays will increase melanin levels, potentially leading to lentigines.
- Lentigines are irregular dark spots usually seen on the face, back, arms, hands and legs.
- AKA - age spots, sunspots, liver spots and freckles.

### ► Hormonal

- Melasma occurs on the face and is induced when the hormone estrogen stimulates the melanocytes.
- Causes uneven patches of dark brown and roughly symmetrical areas.
- Pregnancy and oral contraceptives can cause hyperpigmentation melasma.

### ► Post Inflammatory From Trauma

- Post inflammatory hyperpigmentation (PIH) is an increase in pigmentation seen in the skin after an injury or inflammation to the skin such as a rash, acne breakouts, scratching, bruising, thermal injury or trauma, including surgical procedures



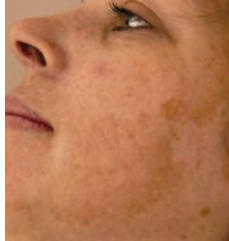
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## Hyperpigmentation II

Sun Damage



Hormonal



Post Inflammatory



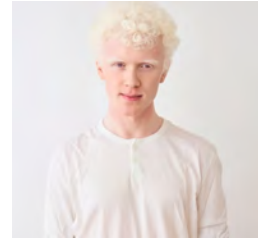
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## Hypopigmentation

- ▶ A deficiency in pigment characterized by smooth white patches in the skin caused by the loss of pigment producing cells.
- ▶ Can be the result of using some drugs or chemicals or diseases such as tuberous sclerosis, pityriasis Alba, lupus erythematosus, and scarring.

### Conditions:

- ▶ Both vitiligo and albinism are aesthetic conditions in which the absence of pigment causes white, smooth spots on the skin.
- ▶ Vitiligo tends to be patchier than albinism and usually does not affect the eye.



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# The Wound

Wound healing can be divided into three major phases:

## 1. Inflammatory

- First phase of wound healing is the inflammatory phase.
- Wound may be red, but certainly swollen.
- May last several days, depending upon severity
- Neutrophils, followed by monocytes/macrophages travel to injury site to scavenge tissue debris and attack infectious activity (phagocytosis)

## 2. Proliferative/rebuilding phase

- Granulation of new tissue formation is followed by epithelialization – or generation of the epidermis over the wound surface, and wound contraction
- Fibroblasts develop and create a new, provisional extracellular matrix by producing collagen and fibronectin

## 3. Remodeling

- Remodeling of collagen – scar tissue formation to replace the damaged tissue
- Depending upon severity, excessive collagen formation may occur with pronounced scar tissue



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# Legal & Regulatory Concerns

- **Unlike Rule 289.301, Rule 289.302 does not specifically require a registered facility to report to DSHS a medical event stemming from improper use of a laser.**
- For a 302 facility, in the event of complication, liability will generally fall under a claim of negligence.
  - Physician may also incur liability for misdiagnoses and/or improper treatment of a medical event under a different standard of care.
  - Laser technician liable for negligence.
  - Owner may be liable for negligent hiring and/or supervision
  - Facility may be liable.



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## Best Practices

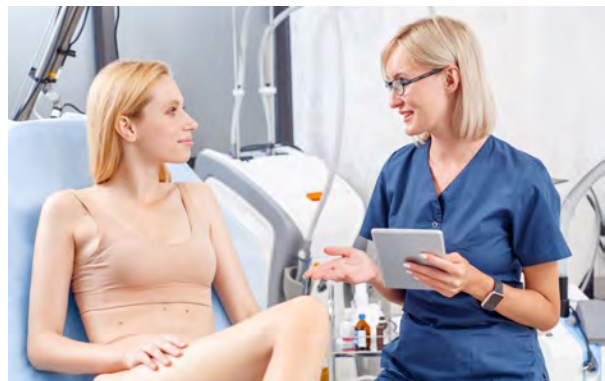
- Gaining “informed consent”
- Signed Release of Liability
- “Outsourcing” medical treatment to off-site consulting physician
- Comprehensive treatment protocols & procedures
- Proactive on-going training for all staff members
- Prudent Laser Safety Officer



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## Response to Complications

- Professional and accommodating.
- Anticipate concerns and reassure expertise.
- Follow-up! And provide expectations.
- Time is on everyone's side.
- Generally, do not refund money or reimburse medical expenses – suggestive of fault. Rather, claims should be settled (with lawyer).
- Be familiar with your professional liability policy. May need to report any potential claim within short time period – otherwise coverage is excluded.



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## Conclusions

- Remember, the skin can heal amazingly well.
- Thermal injury by laser hair removal is very isolated, and with limited cellular memory, permanent side effects are rare.
- Prevention of complication is the best practice – so invest in training, laser maintenance and facility supplies.
- Cool, cool, cool! Cooling the skin post thermal injury is essential.
- Be proactive, not responsive.



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## Laser & IPL Burns: Now What?!

Written By: Robert E. Logue, JD, LSO



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## Laser & IPL Burns: Now What?!

It's 8:30 am, you've just turned on the lights to your office and that proverbial phone call rolls in. "I think you've burnt me! I have blisters all over my legs and I couldn't sleep all night long. I can't believe you did this to me."

Your stomach sinks and your mind goes into a frenzy. "Did I really burn her?" "Will she have pigmentation changes...scars...?" "Am I going to be sued?" "What should I do?!"

This gut wrenching feeling coupled with all of its uncertainty is guaranteed at some point in the career of a laser professional. After all, if you do enough treatments, eventually someone will experience a complication. It doesn't mean that you did anything wrong, but what you do now certainly separates a good laser technician from a true professional.

To know how to proceed, we first need to discuss thermal injury of the skin.

The basics. The skin is comprised of three main layers. The epidermis, the dermis, and the hypodermis or subcutaneous tissue. For the laser practitioner, understanding skin composition is essential for properly determining optimal treatment settings as well as how to address complications. Let's discuss the latter.



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## Determine the Level of Trauma

When a burn occurs, the practitioner must first determine the level of trauma experienced by the client. Just like layers of the skin, there are three degrees of burns. A first degree burn – like a sunburn - exists when the thermal trauma is limited to the epidermis. A second degree burn – manifested by superficial blisters - is more severe, and is defined as thermal injury to the depth of the dermis. And the most severe burn is that to the third degree, where the thermal injury is so deep that damage occurs to one's nerve endings within subcutaneous tissue.

Your response will certainly depend upon the level of injury – which means that you must see the client. And by see, the client should return to your office so that you can see the injury in person! As you undoubtedly know, photographs can be highly misleading and sole reliance upon your client's impressions is nothing more than a wonderful way to provide a great disservice. So take a look!

During your phone conversation, remain relaxed and reassure the client that you're an industry professional with proper training and certification – and that the next step is for you to see the affected area so that the best treatment options can be explored.



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## Examine the Affected Area

Reiterate the importance of quick attention so that the healing process can begin properly and that certain activities, depending upon the complication, may need to be limited until the condition resolves.

But sometimes this request can be a lot easier said than done, I know! Maybe your client is adamant about the inconvenience of returning to your office or is too frustrated to see the value of visiting your clinic in the near future. If this is the case, the best advice is to have the client seek a consultation from a qualified physician most convenient to wherever the client is currently located. Remember, a complication is best treated after a trained professional sees the condition first hand. All too often the client's perspective is much different from the complication that's really at hand.

So what next? Don't drive yourself too crazy with excessive worry. Remember, the skin is an amazing organ that heals impressively well, especially with contained, isolated trauma of the sort laser hair removal treatments may cause. And most injuries look much worse than they really are, particularly with darker skin types, whose melanin composition is markedly superficial. So just hang tight until the client arrives, armed with the confidence that you can take the appropriate next steps.



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## Explore All Variables

The client arrives and you inspect the affected areas. Do you see blistering of the skin? Crusting of the skin? Well defined circular or rectangular marks that match up perfectly with your spot size or handpiece? Red wheals or an itchy rash? Swelling or maybe just pronounced perifollicular edema? Lingering erythema? Purpura? Any pain, discomfort, or soreness? Take pictures and promptly place them in the client chart that same day.

Your general observations will likely lead to fairly easy conclusions. After examining the treated area, start by asking what the client experienced directly following the appointment. If the client now in fact has a burn, the skin would have done just that following the treatment...burn!

So, as an example, if the client reports that they didn't feel any burning sensation following the treatment and at the consultation you determine that the blisters the client had referred to are actually wheals with a pronounced itchy rash, you know you likely have a histamine reaction on your hands and not a thermal injury.



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## Proper Diagnosis & Treatment Considerations

But if a burn is the leading conclusion, continue the discussion by seeking pretreatment activity. Did the client experience recent sun exposure from a weekend jaunt to the beach, begin a new tanning regime at a local salon, or maybe visit a dermatologist and received a photosynthesizing medication? Any changes in an at home skin care regimen to the affected area – perhaps a new tretinoin anti-aging solution or a simple glycolic acid pad that is being used twice daily?

You want to explore all the variables so that proper adjustments can be made for future appointments and, of course, to grow professionally and continue to refine your own skills set to provide the best balance of safety and efficacy in all of your treatments.

So how do you know that you have a burn?

If crusting of the skin is notated and/or well defined reddish burn marks identical to your laser's spot size, but no blisters are present, the thermal injury is likely limited to the epidermis and you have yourself a first degree burn.



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## Additional Considerations

With a sense of relief, you can inform your client of the importance of avoiding additional stimulus to the affected areas such as hot baths, showers, or prolonged sun exposure. And just like the typical sun burn, a full resolution is expected within a few weeks, with topical preparations such as sunscreen, hydration serums, and hydrocortisone creams helping to alleviate minor irritation, protect and soothe the skin and relieve minor itching.

If during your examination you discern superficial blisters and/or notate a breach of the epidermal barrier from a popped blister or separated epidermal tissue, you most likely have a second degree burn. Unlike a first degree burns, second degree burns must be treated much more aggressively. Chance of secondary post treatment infection is certainly possible, and its occurrence is almost synonymous with excessive collagen coagulation – or scar tissue for short. In addition, pigmentation changes, albeit usually temporary, are to be expected.

To mitigate further complication and to enhance the healing process, the use of Silvadene cream 1%, applied up to 4 times a day for the first 4 -5 days, or until the wound begins to scab over is an effective way to reduce the chances of infection while aiding the healing process and granulation of new tissue.



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## Follow Up With Your Client

If your client is allergic to sulfa, in place of Silvadene, Polysporin combined with either Aquaphor Healing Ointment or Biafine is an excellent choice.

Additional consideration must be given to those with diabetes, HIV, AIDS or whose trauma is experienced in susceptible areas of the body to easy infection – such as bikini area treatments. In these cases, oral antibiotic should be considered to further mitigate chances of infection.

Certain lifestyle changes may be necessary in the short term. Of paramount importance, avoidance of prolonged sun exposure is essential. The client should discontinue swimming, baths, or activity that results in constant friction upon the affected area. In addition, heightened consideration for work place contamination must be considered, especially for warehouse or industrial professionals as well as medical professionals in clinical settings.

Once the client is provided with the most appropriate information, it quickly becomes a wait and see exercise. Continue to follow-up with your client, ensuring steady progress while also ruling out possible infection – as usually manifested by continued drainage, swelling, and/or localized pain. Infection must be treated immediately with continued wound care and follow-up visits.



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## Short Term Pigmentation

Once the site heals and at least three weeks of time has lapsed, you'll likely be confronted with short term pigmentation change that should be further addressed. Darker areas, or the occurrence of post inflammatory hyper-pigmentation (PIH), can be treated with skin lighteners, conservative application of chemical exfoliants, and continued sun avoidance.

Lighter areas, or hypo-pigmentation, can be treated with UVB light – or sun exposure. Make sure, however, to distinguish true hypo-pigmentation from one's natural skin color which only looks lighter only because of the surrounding tanned skin.

With the passage of time, the vast majority of burn cases resolve quite nicely – free of further complication, pigmentation change, and the election by the client to resume the normal course of laser treatment.

So now that we know the basic steps of how to address a burn, are there ways a practitioner can discern whether or not a burn is taking place during a treatment?



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## Turn the Fluence Down or Pulse Duration Up

It's tough. Certainly there are the clear examples – severe burning of darker skin types leading to an almost immediate graying appearance or client feedback, with indication of a burning sensation by saying, "It's burning - it didn't feel like this last time."

Remember, if ever in doubt, turn the fluence down and/or pulse duration up, use a longer wavelength or more aggressive cooling. You can always treat more aggressively later.

The not so clear examples are more common. Usually, the client won't experience a burning sensation throughout the course of treatment. The aggressive cooling modality is masking the otherwise developing burning sensation.

As a consequence, it's not until the client begins to check out or begin the drive home that the increasing burning sensation becomes overly apparent. With that said, if a client reports a burning sensation post treatment that is becoming more and more pronounced, you should take immediate steps to mitigate further complication.



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## Cool the Affected Area

Have the client return to a treatment room and begin cooling the affected area by use of a Zimmer, cold compress, or cold running water if feasible. If ice is the most convenient cooling method, place ice in a plastic bag and lay a 4x4 over the affected area. Keep moving the ice pack every 15-30 seconds. Ideally, you will continue to cool the skin as long as the burning sensation is evident – which could last several hours.

Silvadene cream as appropriate should also be applied, pictures taken, and post treatment considerations reviewed. Usually, you won't know what you have until the next day – so patiently follow up with the client in the morning to assess any complication.



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# Proper Operation Protocols and Procedures

With this understanding, you are armed with the fundamental methods by which to address burns. And you no longer need fear that proverbial phone call but rather can take assurance that you can effectively make the best out of an otherwise challenging situation.

But obviously, prevention is key and begins way before a burn ever occurs – do you have proper operating protocols and procedures in place? Training and certification? Consent sheets? Insurance? The right laser systems for the job? Should you issue a refund or pay for doctor's bills? Do I need to report this to a state or federal agency? Charting requirements? And what happens if the client demands compensation?

Remember, state regulations varies greatly as to who can diagnose and treat a medical event. Check with your business attorney to establish your protocols and procedures when addressing complications from laser hair removal treatments.



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## Notes

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