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Complications of Chemical Peeling

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SYNOPSIS

- Chemical peeling is a safe and efficacious technique for skin rejuvenation, yet side effects and complications may occur. If peel solutions are overused, inappropriately used or mismatched with a skin type, operative complications may result.
- The most severe and feared complication due to chemical peeling is permanent scarring.
- Mistakes that lead to complications can occur preoperatively, intraoperatively and postoperatively. The most common complication is patient dissatisfaction with the outcome.
- Chemical peels come in light, medium and deep options. Light chemical peels have fewer complications than the other types. Medium and deeper chemical peels typically have side effects that consist of transient erythema, flushing, increased skin temperature, pruritus, edema, milia formation and acne.

INTRODUCTION

Though chemical peeling has been a safe and efficacious technique for skin rejuvenation for over a half century, side effects and complications can occur. Most, though, are avoidable if the physician has a thorough understanding of the pharmacokinetics of the wounding agents on various skin types and the histology of depth of chemical wounding. Each peeling agent has a particular mechanism to destroy and inflame skin and the physician must have a working knowledge of how that agent will produce favorable benefits on a particular skin type, skin area or skin lesion. All of this information is published and available in the literature for the physician to know how to use these agents.[1,2] When peel solutions are overused, inappropriately used or mismatched with a skin type, then operative complications occur.[3]

Once the peel is completed the recovery and re-growth of new skin occur in a controlled environment in which noxious external factors – trauma, allergy or infection – can induce serious complications. The final common pathway for complication disaster is scarring. This final result can be avoided by careful observation and follow up during the recovery period, and early intervention to re-guide the skin to normal healing.[4]

Mistakes that lead to complications can be made preoperatively by choosing an incorrect peel for a patient, intraoperatively and during postoperative healing. The most common complication is patient dissatisfaction with the procedure. This can be avoided by carefully analyzing the patient's perceived problem and deciding whether it can realistically be treated with a particular type of peel.[5] It is best to give the patient a mirror and allow them to show you the specific problem that bothers them. It may be fine wrinkles, color and texture that are

most amenable to medium-depth chemical peeling, although it may be volume defects that need fillers rather than a peel. The physician must then address which peel is applicable to achieve the desired results. Repetitive light chemical peels can correct pigmentary changes, but produce no significant changes for rhytides which may require a medium chemical peel or deeper resurfacing procedure. One must then look at the patient's specific risks for particular complications, such as hypo- and hyperpigmentation in darker skin types, or the potential for scarring in irradiated skin or during a treatment course of isotretinoin.[6]

If a medium or deep peel is chosen as the procedure to solve the patient's skin problem, the physician must assess the patient's downtime, ability to care for the postoperative wound for 7–14 days and deal with the temporary side effects such as erythema and skin sensitivity. The right choice will give a favorable result with a happy patient. The wrong choice can produce complications – reversible or irreversible – and an unhappy patient.

Generally, light chemical peels have fewer complications than the others. These peels are usually 'lunch time' procedures designed to exfoliate the upper epidermis with minimal dermal inflammation. Healing is usually uncomplicated in 1–3 days. Untoward problems can occur, though, with overcoating low-dose trichloroacetic acid (TCA), leaving glycolic acid in place for prolonged periods or over-aggressively defatting the skin prior to the peel.[7] This can result in edema, prolonged erythema, excessive pain and prolonged exfoliation and healing. This may lead to hyperpigmentation or even scarring. Practitioners should be particularly concerned with those patients with especially sensitive skin such as atopics, patients on regular exfoliating programs or using retinoids and other skin-care programs that may thin the stratum corneum. Most of these problems are reversible with skin protection, bland emollients and appropriate treatment such as topical corticosteroids and bleaching agents. Unmet expectations are the major complications of light chemical peels.

Medium and deep chemical peels create full-thickness destruction of the epidermis along with partial necrosis and inflammation of varying levels of dermis. Aggressive overcoating with 35% TCA or combination TCA peels can drive a medium peel into a much deeper, destructive procedure and potentially cause scarring.[7] The most common complication, though, is hyperpigmentation which can last a week or up to three months, depending on skin type and postoperative care. Medium and deep chemical peels must be considered more serious surgical procedures and deserve the appropriate preoperative consultation and informed consent with a thorough understanding of the postoperative care requirements and sequelae. The complications of these procedures will be considered together.

It is important to distinguish a true complication from an expected side effect of chemical peeling. For example, medium depth and deeper chemical peels usually have side effects of transient erythema, flushing, increased skin temperature, pruritus, edema, milia formation and acne. These are consequences of the new skin formation and should be addressed preoperatively so that their appearance will not alarm the patient. Patient reassurance is usually all that is necessary since these problems will resolve spontaneously.

COMPLICATIONS

Pigmentary changes

Chemical peeling will produce desirable pigmentary changes, such as lightening uneven dyschromia, but these changes must be uniform throughout all areas of the face. Uneven degreasing or peel applications will not only influence differences in peel results but also create pigmentary streaking, pigmentary lines of demarcation around the eyes or mouth or even the jaw line margin in relation to the unpeeled neck.

Though hypo- and hyperpigmentation can occur after any depth of chemical peel, it is the deeper peel procedures that have greater problems. Generally, light complexions (Fitzpatrick skin types I–III) have lower risks. Type IV through Type VI skin must be approached with caution. Type V skin can have medium-depth peels but these may result in hyperpigmentation that requires treatment over a prolonged period of time to reverse. Treatment consists of:

1. a bleaching agent – hydroquinone 4–8%
2. retinoic acid – for exfoliation of pigment

MAJOR POINTS

- Though hypo- and hyperpigmentation may occur after any depth of chemical peel, it is the deeper peel procedures that have the greatest problems with pigmentary changes.
- Generally, hyperpigmentation is more common after superficial- and medium-depth peels, and hypopigmentation is seen more often after deep peels such as with phenol and laser resurfacing.
- Treatment for hyperpigmentation should begin directly after re-epithelialization is complete and continue for approximately 4–6 weeks. Most importantly, the patient must use sunscreen protection and practice sun avoidance for 3–6 months.
- Other factors that promote hyperpigmentation after a chemical peel include: birth control pills, exogenous estrogens, photosensitizing drugs, steroids and excessive sun or tanning bed exposure.
- Long-term or permanent hypopigmentation can be the result of deep peeling or resurfacing in darker skin types (Fitzpatrick skin types IV–VI).
- The final common result of peel complications is scarring. Scars can be grouped into three types: textural, atrophic/hypopigmented and contractile.

3. mild corticosteroids – grade 4 or 5
4. non-inflammatory light chemical peeling such as salicylic acid (20% aqueous) or glycolic acid (30–40%).

Generally, hyperpigmentation is more common after superficial- and medium-depth peels, and hypopigmentation after deep peels such as with phenol and laser resurfacing. Hyperpigmentation can commonly occur after minimal sun exposure during the erythematic phase of healing. This usually responds well to bleaching agents, tretinoin, corticosteroids and sunscreen protection as outlined above.[8] Treatment for hyperpigmentation should begin in susceptible skin types directly after re-epithelialization is complete and continue for 4–6 weeks. Of primary importance is the use of sunscreen protection and sun avoidance for 3–6 months. It is helpful to pretreat susceptible skin types IV–VI with hydroquinone 6–8 weeks prior to peeling as a preventive measure. The bleaching agents are then resumed after re-epithelialization.

Other factors that promote hyperpigmentation after peeling include birth control pills and exogenous estrogens, photosensitizing drugs, steroids and excessive sun or tanning bed exposure prior to and after peeling. If post-peel hyperpigmentation does not respond to topical treatments alone, repeated light chemical peels can be a helpful adjunct. Selective lasers such as Q-switch YAG 532 and intense pulsed light sources have been claimed to be helpful in treating resistant post-peel pigmentation or for resurfacing pigmentary problems.[9]

Hypopigmentation is a normal event in peeling, to a degree. The removal of photo-damaged, dyschromic epidermis evens a 'muddy complexion' and brightens skin as a positive result of chemical peeling. Thus, in fair-complected skin a medium-depth chemical peel will restore a lighter, pre-sun-damaged facial skin complexion. In both superficial- and medium-depth chemical peeling, the removal of the epidermis and its contained melanin will temporarily lighten the skin but color will return as migrating melanocytes from pilosebaceous complexes repigment the new skin. This is especially apparent in type IV through VI skin.[10] The greater risk is a reactive hyperpigmentation in darker skin types, more than prolonged hypopigmentation. Long-term or permanent hypopigmentation can be the result of deep peeling or resurfacing in darker skin types. This is especially true with aggressive, taped phenol peels which may destroy the reserve of melanocytes in pilosebaceous apparatus needed to resurface the epidermis. There may also be a 'melanotoxic' effect of the deeply-penetrating phenol on melanocytes. The author feels that this is a direct result of deep-depth injury, which can also be seen after ablative laser resurfacing.

The skin has an 'alabaster' or plastic appearance with deep peeling due to destruction of the papillary dermis along with resultant hypopigmentation.[11] Though this was an acceptable side effect of deep phenol peeling in past decades, it is no longer tolerated by our patients, and resurfacing of this depth should be avoided.

The final common result of peel complications is scarring. The factors that lead to this disastrous result are multiple and, at times, additive. They can

be classified as intrinsic, operative and postoperative (Table 12.1).

Resultant scars are divided into three types based on severity:

1. Textural scar – ablation of superficial skin structure.
2. Atrophic and hypopigmented scars – upper dermal damage.
3. Contractile scar – the result of full-thickness injury.

These particular scar variants are dependent on depth of wound injury, area of treatment and complicating postoperative factors such as infection, trauma or allergy. Textural changes such as enlarged pores (or 'grainy texture') can be seen after medium or deep peels due to inflammation of the high papillary dermis, widening the pore exit to the skin surface. Atrophy and hypopigmentation with an irregular contour characterize a wound through the mid dermis while contractile or pulling scars are full-thickness dermal injuries with deep dermal scarring. These create the worst deformities such as lower lid ectropion or lip and nasal alar distortions. Early intervention into causative or postoperative healing factors can help prevent some of these worst scarring complications.

POSTOPERATIVE COMPLICATIONS

MAJOR POINTS

- Infection is a postoperative complication of chemical peeling because the treated skin is damaged and vulnerable.
- Inadequate debridement of necrotic and dead tissue and the use of occlusive ointments contribute to the growth of bacterial and yeast infections.
- Herpes simplex virus (HSV) outbreaks can be triggered by the chemical peel procedure. Prophylactic therapy is recommended for all medium-depth and deeper peel patients despite having a negative medical history of outbreaks.
- Delayed wound healing and persistent erythema are other complications seen postoperatively. Typical clinical presentations are painful, open erosions with friable granulation tissue remaining present well beyond the time that re-epithelialization should be completed.
- A prolonged granulation phase may indicate imminent scarring and, therefore, the physician should treat aggressively to complete re-epithelialization and proper healing.

Table 12.1 Risks of scarring

Intrinsic	Operative	Postoperative
Hereditary skin type	**Over-treatment creating a wound beyond the mid-reticular dermis**	**Infection**
Discoid lupus erythematosus	Repeated overcoating with 25–40% TCA	Bacterial: *Staphylococcus, Pseudomonas, Escherichia coli Candida*
Scleroderma	Use of 50% or above TCA	Viral: herpes simplex disseminated
Atopic	Over-aggressive use of phenol	
Ehlers-Danlos syndrome	**Aggressive treatment of scar-proned areas on the face**	**Trauma**
Keloid tendency	Forehead	Irritants
Compromised skin healing	Malar prominence	Allergens
Irradiated skin (absence of pilosebaceous apparatus)	Eyelids	Physical factors that wound skin
Poikilodermatous atrophy	Jaw line	Picking and excoriating
Undermined skin from prior surgery	**Aggressive treatment of non-facial skin**	**Idiopathic prolonged wound healing**
Isotretinoid therapy within last six months	Especially vertical neck, chest, shoulders	**Idiopathic prolonged erythema**
Poor health and nutritional status		
Active infection or open wounds, excoriations and inflammatory acne		
Inflamed from active skin disease or retinoid dermatitis		

During the postoperative period of wound healing, the damaged skin is susceptible to infection. Factors contributing to bacterial or yeast infections are inadequate debridement of necrotic and dead tissue which can become bacterial culture media, and occlusive ointments such as petrolatum and moisturizers. The mineral and vegetable fats used for occlusive healing can promote the growth of pathogens such as *Streptococcus*, *Staphylococcus* and *Pseudomonas*. Regular, gentle debridement of necrotic tissue, and ointments using ¼% acidic solution (1 tablespoon white vinegar in 1 part of warm water) are necessary to encourage the normal phases of wound healing including granulation, re-epithelialization and fibroplasia. Systemic antibiotics are not usually necessary in open healing with good debridement, thus bacterial infection is rare if good hygiene, postoperative soaks and careful observation are enforced.[12] It is important for the physician to see the patient regularly during the postoperative period to catch signs of early bacterial infection, to culture the exudate and place the patient on the appropriate antibiotic. If infection is neglected and left untreated, it will lead to delayed wound healing and final scarring.

Candida infection has been classified after occlusive healing without debridement while the patient is on systemic antibiotics. Yeast overgrowth should be treated aggressively with soaks and debridement plus oral ketoconazole and fluconazole.[13]

Herpes simplex outbreaks can be triggered by the trauma induced by a chemical peel. A careful history of prior herpes simplex virus I (HSVI) outbreaks will reveal those patients who require prophylactic therapy, even with superficial peels. Because many patients do not know if they have had HSV and are carriers, I put all medium-depth and deeper-peel patients on prophylactic therapy; valaciclovir, 500 mg twice a day for 10–14 days. If herpes simplex infection occurs during the postoperative phase, the vesicular infection can spread over the entire peeled area and has the potential for devastating sequelae and scarring. Vesicles are rare on denuded skin, but the sudden onset of pain in the midst of uneventful wound healing is a classic sign of HSV infection and should prompt the initiation of aggressive and antiviral therapy (valaciclovir, 500 mg t.i.d. or q.i.d.).[14]

Delayed wound healing and persistent erythema are other complications which are important to recognize early in the postoperative course. The patient presents with painful, open erosions with friable granulation tissue remaining present well beyond the time re-epithelialization should be completed. It can occur during the 2nd week of a medium-depth peel and continue for weeks. A prolonged granulation phase is a stimulus for scarring and should be treated aggressively to complete re-epithelialization and healing. Empiric antimicrobial therapy, to cover the possibility of an underlying bacterial, yeast or herpetic infection, is instituted until culture results are available. Close follow up with daily dressing changes using a commercial biosynthetic membrane such as Vigilon (CR Bard Inc., Covington, GA) is the treatment of choice.[15]

Persistent erythema

MAJOR POINTS

- The degree and extent of erythema is dependent on the depth of injury and type of procedure. Laser resurfacing always has a more prolonged period of erythema when compared to chemical peeling.
- Superficial peels are erythematous for days, medium-depth peels are erythematous for 2–3 weeks, and deep peels may remain erythematous for up to 4–6 weeks. Any redness visualized beyond these time frames can be defined as persistent erythema.
- Persistent erythema can be accompanied by prolonged pruritus, burning or stinging sensations and irregularities in skin texture.
- Persistent erythema may indicate the impending development of a scar.
- Therapy of persistent erythema should emphasize protection of the skin from irritating agents and the use of corticosteroid anti-inflammatory agents (topical and/or systemic). If the erythematous area begins to feel firm and indurated, it may indicate that scar formation is beginning. Therefore, treatment should include intralesional corticosteroids into the firm areas with adjunct topical steroids to avoid scar formation. Pulsed dye laser has also been successfully used for the treatment of scars.

All patients undergoing a resurfacing procedure will have some degree of erythema postoperatively for a limited period of time. The degree and extent of redness are dependent on the depth of injury and procedure type. Laser resurfacing always has a more prolonged period of erythema than does chemical peeling. While superficial peels are erythematous for days, medium-depth peels are normally erythematous for 2–3 weeks, and deep peels may remain erythematous for 4–6 weeks. The deviation of redness beyond the normal duration is defined as persistent erythema and should signal a red flag for the physician. Persistent erythema is accompanied by prolonged pruritus, burning or stinging sensations and irregularities in skin texture. It may represent a sensitivity to topical agents such as allergy to antibiotic ointment or irritation from a lanolin, make-up or moisturizer, or early usage of a retinoid. It may also be an indication of intrinsically sensitive skin such as atopic dermatitis, separate dermatitis or rosacea. The surgeon should attempt to identify and correct any underlying factors that may be contributing to the problem. This is most important because persistent erythema may indicate the impending development of a scar.[16]

Therapy of persistent erythema should emphasize protection of the skin from noxious and irritating agents and the use of corticosteroid anti-inflammatory agents – topical and/or systemic – to halt the process. If the erythematous area begins to feel firm and indurated, it may indicate that scar formation is beginning. Treatment should include intralesional corticosteroids (2.5 or 5mg % triamcinolone acetonide) into the firm areas, with topical steroids as adjunct treatment. If scarring is treated early, it can be prevented and corrected. The treatment of erythematous scars includes intralesional corticosteroids, topical corticosteroids under occlusion, silicone sheeting and pulsed dye laser treatment. In many cases, the early fibroplasia stage exhibited by induration and erythema can be reversed, preventing the final results of scar formation and deformity.

SUMMARY

Although peels, like all other surgical procedures, can result in complications and adverse sequelae, these can be minimized with careful technique, close patient observation and appropriate intervention when necessary. Proper physician training in choosing the correct patients for the procedures, performing the procedures conservatively and safely and being thoroughly knowledgeable of all untoward sequelae will help to ensure that chemical peel remains the safe and efficacious procedure it has always been.

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