CHAPTER 1
Peels

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Key points

- Chemical peels remain one of the most popular and least expensive cosmetic procedures
- Peels are most easily divided by depth of penetration into superficial, medium, and deep
- The depth of peels can be generally correlated to the depth of a similar laser treatment
- Medium-depth chemical peels are the most popular physician-use peels

Introduction

Aging of the skin is the combined result of both intrinsic factors and extrinsic (external) influences from the environment. Intrinsic aging is the role played by genetics in relation to chronologic age. The intrinsic processes include alteration of skeletal mass and proportion, atrophy and redistribution of subcutaneous fat, increased laxity of underlying fascia and musculature, and skin changes characterized by thinning and atrophy. Most intrinsic factors cannot be prevented, but rejuvenative changes can be made with cosmoceutical agents and resurfacing procedures.

Extrinsic factors are preventable environmental influences leading to premature aging of the skin, including ultraviolet (UV) exposure, smoking, chemicals, and gravity. UV exposure is the primary environmental factor, preferentially affecting those with a lighter skin color. The mechanism includes the production of UV-induced oxygen free radicals, which have been shown to invite a cascade of molecular events leading to the production of collagen-degrading enzymes. This creates the characteristic features of photoaging, including rough texture, atrophy, fine and coarse wrinkles, sallow and leathery appearance with dyschromia [1].

In the evaluation of the patient with photoaging, emphasis must be placed on prevention as much as on treatment. Agents available range from cosmoceutical topical agents to filling agents that include resurfacing devices such as chemical peels, ablative resurfacing lasers, and dermabrasion. An initial

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consultation is performed to determine which of these tools is best for the patient, based on the severity and extent of the condition.

Ablative resurfacing injures the skin in a controlled fashion to a specific depth, encouraging the growth of new and improved skin. These methods include chemical peeling, dermabrasion, and laser resurfacing. Skin resurfacing techniques are divided into superficial, medium-depth, and deep, relating to the level of injury. The deeper procedures are restricted to the face, as other body areas do not have the healing capacity to rejuvenate new skin after such an injury. Care must also be taken with the neck, which may scar with medium-depth or deep injury [2].

The classification system shown in Table 1.1 is useful in categorizing skin resurfacing methods. It is based on the objective data collected by Stegman, who correlated strengths of trichloroacetic acid (TCA) by biopsy to depth of tissue destruction and then new collagen rejuvenation [3]. Thus superficial, medium-depth, and deep resurfacing correlates modalities of peeling, dermabrasion, and laser to common denominators – inflammation and injury.

A useful method of assessing skin-related photoaging is the Monheit–Fulton index (Table 1.2). This system categorizes the visual changes in photoaging skin and quantifies the amount to guide the physician with appropriate therapy. The system combines age-related textural and lesional changes into a numeric system that will predict how aggressive a physician should be in using superficial, medium-depth, and deep resurfacing procedures [4].

Chemical peeling

Chemical peeling remains one of the most popular choices for both patient and physician. In comparison to some of the newer options available, chemical peels have a long-standing safety and efficacy record, are performed with ease, are low in cost, and have a relatively quick recovery time. Various acidic and basic compounds are used to produce a controlled skin injury, and they are classified as superficial, medium-depth, and deep peeling agents according to their level of penetration, destruction, and inflammation (Table 1.1). In general, superficial peels cause epidermal injury and occasionally extend into the papillary dermis, medium-depth peels cause injury through the papillary dermis to the upper reticular dermis, and deep peels cause injury to the mid-reticular dermis [3].

Prior to the application of peeling solutions, the physician must vigorously cleanse the skin surface to remove residual oils, debris, and excess stratum corneum. The face is initially scrubbed with 4″ × 4″ gauze pads containing 0.25% Irgasan (Septisol, Vestal Laboratories, St. Louis, Missouri), then rinsed with water and dried. Because of the defatting and degreasing properties of

Table 1.1 Classification of ablative skin resurfacing methods.

Superficial – very light*
Low-potency formulations of glycolic acid or other alpha-hydroxy acid
10–20% TCA (weight-to-volume formulation)
Jessner's solution (Table 1.3)
Tretinoin
Salicylic acid
Microdermabrasion
Superficial – light*
70% glycolic acid
Jessner's solution
25–35% TCA
Solid CO_2 slush
Microdermabrasion
Medium-depth
88% phenol
35–40% TCA
Jessner's + 35% TCA
70% glycoloic acid + 35% TCA
Solid CO_2 + 35% TCA
Conservative manual dermasanding
Erbium: YAG laser resurfacing
Conservative CO_2 laser resurfacing
Deep
Unoccluded or occluded Baker–Gordon phenol peel
TCA in concentrations > 50%
Wire brush or diamond fraise dermabrasion
Aggressive manual dermasanding
Manual dermasanding or motorized dermabrasion after a medium-depth peel
Aggressive erbium: YAG laser resurfacing
CO_2 laser resurfacing
Combination erbium: YAG/CO_2 laser resurfacing

Although this classification represents an oversimplification, because the actual depth of injury varies somewhat along a continuum for each type of resurfacing procedure, it is helpful when discussing the various options with a patient.
TCA, trichloroacetic acid; YAG, yttrium aluminum garnet.
* Techniques for ablative laser resurfacing of superficial depth have been developed but are probably impractical.

acetone, gauze pads moistened in an acetone preparation are then used to cleanse the skin even further. The importance of cleansing in the peeling procedure cannot be overemphasized. A thorough and evenly distributed cleansing and degreasing of the face ensures uniform penetration of the peeling solution and leads to an even result without skip areas (Fig. 1.1) [5].

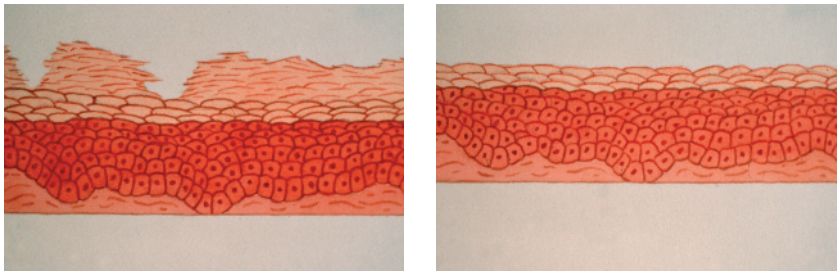
Table 1.2 Monheit–Fulton index of photoaging skin.

Texture changes	Points				Score
Wrinkles – dynamic	1	2	3	4	
(% of potential lines)	<25%	<50%	<75%	<100%	
Wrinkles – photoaging	1	2	3	4	
(% of potential lines)	<25%	<50%	<75%	<100%	
Cross-hatched lines – fine lines	1	2	3	4	
(% of potential lines)	<10%	<20%	<40%	<60%	
Sallow color and dyschromia	1	2	3	4	
	Dull	Yellow	Brown	Black	
Leathery appearance	1	2	3	4	
Crinkly (thin & parchment)	1	2	3	4	
Pebbly (deep whitish nodules)	2	4	6	8	
(% of face)	<25%	<50%	<75%	<100%	
Pore # and size	2	4	6	8	
	<25%	<50%	<75%	<100%	
Lesions	**Points**				**Score**
Freckles – mottled skin	1	2	3	4	
(# present)	<10	<25	<50	<100	
Lentigenes (dark/irregular)	2	4	6	8	
& SK's (size)	<5 mm	<10 mm	<15 mm	<20 mm	
Telangiectasias – erythema flush	1	2	3	4	
(# present)	<5	<10	<15	>15	
AK's and SK's	2	4	6	8	
(# present)	<5	<10	<15	>15	
Skin cancers	2	4	6	8	
(# present – now or by history)	1 ca	2 ca	3 ca	>4 ca	
Senile comedones	1	2	3	4	
(in cheekbone area)	<5	<10	<20	>20	
Total score					

Corresponding rejuvenation program

Score	Needs
1–6	Skin care program with tretinoin, glycolic acid peels
7–11	Same plus Jessner's peel; pigmented lesion laser and/or vascular laser
12–16	Same plus medium peel – Jessner's + TCA peel; skin fillers and/or botulinum toxin
17 or more	Above plus laser resurfacing

The effect of a chemical peel is dependent upon the agent used, its concentration, and the techniques employed before and during its application. Each wounding agent used in peels has unique chemical properties and causes a specific pattern of injury to the skin [2]. It is important for the



(A) (B)

Figure 1.1 (A) Irregular surface. (B) Clean, regular surface.

physician using these solutions to be familiar with their cutaneous effects and proper methods of application, to ensure correct depth of injury. This chapter will therefore focus on the specific chemical agents that are actively responsible for producing the various patterns of injury.

Superficial chemical peeling

Superficial chemical peels are indicated in the management of acne and its post-inflammatory erythema, mild photoaging (Glogau I and II), epidermal growths such as lentigines and keratoses, as well as melasma and other pigmentary dyschromias. Multiple peels on a repeated basis are usually necessary to obtain optimal results. The frequency of peels and degree of exposure to the peeling agent may be increased gradually as necessary. Results are enhanced by medical or cosmoceutical therapy. All superficial chemical peels share the advantages of only mild stinging and burning during application, as well as minimal time needed for recovery.

Superficial chemical peels are divided into two varieties – very light and light (Table 1.1). With very light peels, the injury is usually limited to the stratum corneum and only creates exfoliation, but the injury may extend into the stratum granulosum. The agents used for these peels include low-potency formulations of glycolic acid, 10–20% TCA, Jessner's solution (Table 1.3), tretinoin, and salicylic acid. Light peels injure the entire epidermis down to the basal layer, stimulating the regeneration of a fresh new epithelium. Agents used for light peels include 70% glycolic acid, 25–35%

Table 1.3 Jessner's solution (Combe's formula).

Resorcinol	14 g
Salicylic acid	14 g
85% lactic acid	14 g
95% ethanol (QSAD)	100 mL

QSAD, *quantum satis ad dispensum* (quantity sufficient to make the total).

(A)

(B)

(C)

Figure 1.2 (A) Level I frosting, as found with light chemical peeling: erythema with streaky frosting. (B) Level II: erythema with diffuse white frosting. (C) Level III: solid white enamel frosting.

TCA, Jessner's solution, and solid carbon dioxide slush [6]. During the application of superficial peeling agents, there may be mild stinging followed by a level I frosting, defined as the appearance of erythema and streaky whitening on the surface (Fig. 1.2A, Table 1.4).

Alpha-hydroxy acid (AHA) peeling agents have been used widely in skin rejuvenation programs since the early 1990s. The depth of injury is determined by the specific AHA used, its pH, the concentration of free acid, the volume applied to the skin, and the duration of contact or time the agent is left on the skin before neutralization [7]. In low concentrations (20–30%) AHAs have been shown to decrease the cohesion of corneocytes at the junction of the stratum corneum and the stratum granulosum, while higher concentrations (70%) are associated with complete epidermolysis. Weekly or biweekly applications of 40–70% unbuffered glycolic acid with cotton swabs, a sable brush, or 2″ × 2″ gauze pads have been used most often for acne, mild photoaging, and melasma [7]. The time of application is critical for glycolic acid, as it must be rinsed off with water or neutralized with 5% sodium bicarbonate after 2–4 minutes.

Application of 10–20% TCA with either a saturated 2″ × 2″ gauze pad or sable brush produces erythema and a very light frost within 15–45 seconds. The depth of penetration of the peeling solution is related to the number of coats applied, so deeper penetration and injury can occur with overcoating. Ideally, a level I frosting is obtained with a superficial TCA peel. Protein precipitation results and leads to exfoliation without vesiculation. Concentrations of TCA up to 35% can also be used alone as a superficial

peeling agent, but this may create an injury that extends partially into the upper dermis [6].

Jessner's solution is a combination of keratolytic ingredients that has been used for over 100 years in the treatment of inflammatory and comedonal acne as well as hyperkeratotic skin disorders (Table 1.3). Jessner's solution has intense keratolytic activity, initially causing loss of corneocyte cohesion within the stratum corneum and subsequently creating intercellular and intracellular edema within the upper epidermis if application is continued [8]. The mode of application for the Jessner's peel is similar to that of the 10–20% TCA peel. The clinical endpoint of treatment is erythema and blotchy frosting. It is a good repetitive peel for photoaging skin because of its inflammatory effects. The peel can be repeated every 2 weeks.

Salicylic acid, a beta-hydroxy acid that is one of the ingredients in Jessner's solution, can also be used alone in superficial chemical peeling [9]. It is a preferred therapy for comedonal acne as it is lipophilic and concentrates in the pilosebaceous apparatus. It is quite effective as an adjunctive therapy for open and closed comedones and resolving post-acne erythema (Fig. 1.3). It is also a peel of choice for melasma and pigmentary

(A)

(B)

(C)

Figure 1.3 Salicylic acid peels are effective for the treatment of acne and comedones. In the case of acne, repetitive treatment over six weeks will hasten resolution of the condition. (A) Pre-treatment, active acne. (B) Perifollicular frosting seen with salicylic acid. (C) Six weeks after treatment.

dyschromia because it has minimal inflammatory action. Used repeatedly, it has the least risk of post-inflammatory hyperpigmentation. For abnormal pigmentation, superficial peeling is combined with skin care and topical retinoids, a bleaching product (including 4–8% hydroquinone), and an adequate sunscreen [10].

Prior to the initial treatment with a superficial peel, both patient and physician must understand the limitations, especially on photoaging, to avoid future disappointment. The effect of repetitive superficial chemical peels never approaches the beneficial effect obtained with a single medium-depth or deep peel. The improvements in photoaged skin following superficial peels are usually subtle, because there is little to no effect on the dermis. Nevertheless, their ease of use and minimal downtime makes these "lunchtime" peels rewarding for patients with realistic expectations.

Medium-depth chemical peeling

Medium-depth chemical peels consist of controlled damage through the epidermis and papillary dermis, with variable extension to the upper reticular dermis. During the next 3 months, postoperatively, there is increased collagen production with expansion of the papillary dermis and the development of a mid-dermal band of thick, elastic-staining fibers [3]. These changes correlate with continued clinical improvement during this time.

For many years, 40–50% TCA was the prototypical medium-depth peeling agent because of its ability to ameliorate fine wrinkles and actinic changes, and to remove pre-neoplasia. TCA as a single agent for medium-depth peeling has fallen out of favor because of the high risk of complications, especially scarring and pigmentary alterations, when used in strengths approaching 50% and higher [11]. Today, most medium-depth chemical peels are performed utilizing 35% TCA in combination with either Jessner's solution, 70% glycolic acid, or solid carbon dioxide (CO_2) as a "priming" agent. These combination peels have been found as effective as 50% TCA alone but with fewer risks. The level of penetration is better controlled with these combination peels, thereby avoiding the scarring seen with higher concentrations of TCA.

Brody developed the use of solid CO_2 to freeze the skin prior to the application of 35% TCA. This causes complete epidermal necrosis and significant dermal edema, thereby allowing deeper penetration of the TCA in selected areas [5]. Monheit then described a combination medium-depth peel in which Jessner's solution is applied, followed by 35% TCA [8]. Similarly, Coleman and Futrell have demonstrated the use of 70% glycolic acid prior to the application of 35% TCA for medium-depth peeling [12]. The Jessner's solution and glycolic acid both appear to effectively weaken

the epidermal barrier and allow deeper, more uniform, and more controlled penetration of the 35% TCA.

Current indications for medium-depth chemical peeling include Glogau level II or moderate photoaging, epidermal lesions such as actinic keratoses, pigmentary dyschromias, mild acne scarring, as well as to blend the effects of deeper resurfacing procedures. The most popular of the medium-depth peels for facial rejuvenation is the Jessner's + 35% TCA peel, with other combination peels being utilized less frequently. This peel has been widely accepted because of its broad range of uses, the large number of people in whom it is indicated, its ease of modification according to the situation, and its excellent safety profile. However, it is not a "lunchtime" treatment and should be considered a surgical procedure requiring preoperative consultation and preparation, operative sedation, and aftercare for 1 week or more.

The Jessner's + 35% TCA peel is particularly useful for the improvement of mild to moderate photoaging (Fig. 1.4). It freshens sallow, atrophic skin and softens fine rhytides with minimal risk of textural or pigmentary complications. Collagen remodeling occurs for as long as 3–4 months postoperatively, during which there is continued improvement in texture and rhytides. When used in conjunction with a retinoid, bleaching agent, and sunscreens, a single Jessner's + 35% TCA peel lessens pigmentary dyschromias and lentigines more effectively than repetitive superficial peels (Fig. 1.5). Epidermal growths such as actinic keratoses also respond well to this peel. In fact, the Jessner's + 35% TCA peel has been found as effective as topical 5-fluorouracil chemotherapy in removing both grossly visible and clinically undetectable actinic keratoses, but it has the added advantages of lower morbidity and greater improvement in associated photoaging (Fig. 1.6) [13].

This peel is also useful to blend the effects of other resurfacing procedures with the surrounding skin. Patients who undergo laser resurfacing, deep chemical peeling, or dermabrasion to a localized area such as the periorbital or perioral region often develop a sharp line of demarcation between the treated and untreated skin. This is because the surrounding photoaging skin has significant dyschromia and textural aging. The treated skin may appear hypopigmented (also known as pseudohypopigmentation) in comparison to the untreated skin. A Jessner's + 35% TCA peel performed on the adjacent untreated skin helps to blend the treated area into its surroundings. For example, a patient with advanced photoaging in the periorbital region and moderate photoaging on the remaining face may desire CO_2 laser resurfacing only around her eyes. In this patient, medium-depth chemical peeling of the areas not treated with the laser would improve the photoaging in these regions and avoid a line of demarcation [14]. It is important to note that when used in combination with other resurfacing procedures such as laser resurfacing or dermabrasion, the peel should be

(A)

(B)

(C)

Figure 1.4 Medium-depth chemical peel used to treat moderate photoaging skin. (A) Preoperative appearance, demonstrating epidermal growths with aging textural changes. (B) Application of 35% TCA directly after Jessner's solution. (C) White enamel frosting (level III) from 35% TCA.

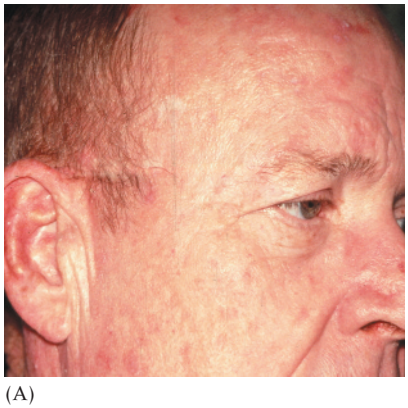
performed first in order to avoid accidental application of the peeling agent onto previously abraded areas of skin (Fig. 1.7).

Using either cotton-tipped applicators or 2″ × 2″ gauze pads, a single, even coat of Jessner's solution is applied first to the forehead, then the cheeks, nose, and chin, and lastly the eyelids. Proper application of Jessner's solution causes minimal discomfort and creates a faint frost within a background of mild erythema (level I). After waiting 1–2 minutes for the Jessner's

(A)

(B)

Figure 1.5 Post-inflammatory hyperpigmentation unresponsive to topical agents (hydroquinone and tretinoin) and superficial chemical peeling. Full response to medium depth chemical peel and topical agents. (A) Preoperative; (B) six weeks postoperative.



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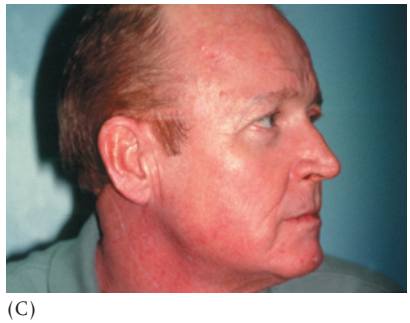
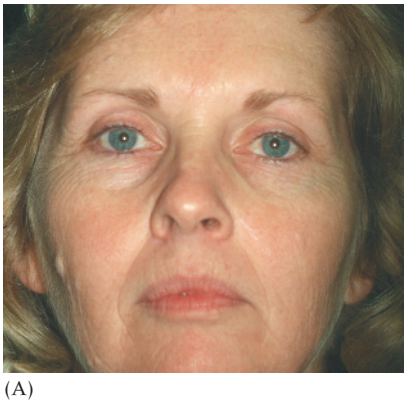


(C)

Figure 1.6 Medium-depth chemical peel for treatment of diffuse actinic keratoses and photoaging. Jessner's + 35% TCA was used as a single treatment with healing in eight days. (A) Preoperative; (B) frosting after TCA; (C) one month postoperative.

solution to completely dry, 35% TCA is then applied evenly with one to four cotton-tipped applicators (Fig. 1.8). The effectiveness of this peel is directly dependent upon the depth of penetration of the peeling solutions, and this depth is a function of the adequacy of degreasing and the amount of both solutions applied. The use of cotton swabs, particularly for the



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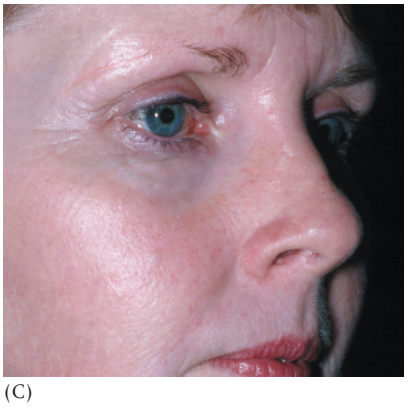


(C)

Figure 1.7 Combination procedure utilizing perioral–periorbital CO_2 laser resurfacing, with Jessner's + 35% TCA peel over remaining face. The peel will blend color and texture of the laser-treated areas. (A) Preoperative: the eyelids and lips need deeper resurfacing than the cheeks, which require only medium-depth injury; (B) four days postoperative: note difference in rate of healing between laser- and peel-treated areas; (C) one year postoperative.

application of TCA, is advantageous because is allows the surgeon to easily vary the amount of solution applied according to the patient's specific needs. The amount of TCA delivered to the skin surface is determined by the number of applicators used, their degree of saturation, the amount of pressure applied to the skin surface, and the duration of their contact with the skin. Four moist cotton-tipped applicators are applied in broad strokes over the forehead and on the medial cheeks. Two mildly soaked cotton-tipped applicators can be used across the lips and chin, and one damp cotton-tipped applicator on the eyelids. The depth of penetration and completion of the peel reaction can be monitored by the level of frosting. A full combination Jessner's + 35% TCA peel should obtain a level II–III frosting. One should never overcoat TCA on a level III frosting, as the injury may be pushed to a level that can cause complications, i.e., pigmentation or scarring.

Anatomic areas of the face are peeled with TCA sequentially from forehead to temple to cheeks, and finally to the lips and eyelids. Careful feathering of the solution into the hairline and around the rim of the jaw and brow conceals the demarcation line between peeled and non-peeled skin. Areas of wrinkled skin are stretched taut with the help of an assistant

(A) (B)

(C) (D)

Figure 1.8 Technical aspects of the Jessner's + 35% TCA peel. (A) Appearance of level I frosting after application of Jessner's solution: erythema with blotchy frosting. (B) 35% TCA applied after Jessner's solution dries with an even application using one to four cotton-tipped applicators: a level III or white enamel frosting is obtained. (C) Eyelids are treated with one cotton-tipped applicator moistened with 35% TCA; a dry applicator is used to absorb tears during eyelid peeling. (D) Lip rhytides are peeled with saturated cotton tip applicators; the wooden shaft is used to rub peel solution further in to the lip rhytides.

to allow even application of the solution into the folds and troughs. This technique is particularly helpful on the skin of the upper and lower lips. For perioral rhytides, TCA is applied with the wood portion of a cotton-tipped applicator and extended onto the vermilion border (Fig. 1.8D).

Eyelid skin must be treated delicately and carefully to avoid over-application and to prevent exposure of the eyes to TCA solution [15]. The patient should be positioned with the head elevated at 30 degrees, and excess peel solution on the cotton tip should be squeezed out so that the applicator is semidry. A single applicator is rolled gently from the periorbital skin onto the upper eyelid skin without going beyond the moveable lid. Another semidry applicator is then rolled onto the lower eyelid skin within 2–3 millimeters of the lid margin while the patient is looking superiorly.

Table 1.4 Grades of frosting with TCA peels.

Grade	Visual finding
I	Erythema with streaky frosting
II	White frosting with visible erythema
III	White enamel frosting – no erythema

Excess peel solution should never be left on the lids, because it can roll into the eyes, and tears should be immediately dried with a cotton-tipped applicator, because they may pull the solution into the eye by capillary action.

The white frost from the TCA application appears on the treated area within 30 seconds to 2 minutes (Fig. 1.4C). This response is representative of keratocoagulation and indicates that the TCA's physiologic reaction is complete. TCA takes longer to frost than phenol preparations, but a shorter period of time than the superficial peeling agents. The desired endpoint in medium-depth peeling is level II–III frosting (Table 1.4). Level II frosting is defined as a white-coated frosting with a background of erythema (Fig. 1.2B).

Level III frosting, which is associated with penetration to the reticular dermis, is a solid white enamel frosting with no background of erythema (Fig. 1.2C). A deeper level III frosting should be restricted only to areas of thick skin and heavy actinic damage. Most medium-depth chemical peels achieve a level II frosting, and this is especially important over the eyelids and areas of sensitive skin. Areas with a greater tendency to form scars, such as the zygomatic arch and the bony prominences of the jawline and chin, should receive no greater than level II frosting.

Before re-treating an area with inadequate frosting, the surgeon should wait at least 3–4 minutes after the application of TCA to ensure that frosting has reached its peak. Each cosmetic unit is then assessed, and areas of incomplete or uneven frosting are carefully re-treated with a thin application of TCA. Additional applications of TCA increase the depth of penetration as well as the risk of complications, so one should apply more solution only to the under-frosted areas.

Although there is an immediate burning sensation as the peel solution is applied, the discomfort begins to subside as frosting occurs and resolves fully by the time of discharge. This peel can be performed with light sedation, such as:

- diazepam 10 mg orally
- meperidine 50 mg intramuscularly
- hydroxyzine 25 mg intramuscularly

After cooling the skin with saline, the patient will remain comfortable throughout the postoperative period. Cool saline compresses offer

symptomatic relief at the conclusion of the peel. Unlike the compresses in glycolic acid peels, the saline following a TCA peel simply provides relief and does not "neutralize" the acid.

Deep chemical peeling

Patients with more extreme skin photoaging may require deep chemical peeling, motorized dermabrasion, or laser resurfacing to improve their greater degree of skin damage. As discussed with medium-depth peels, deep chemical peeling leads to production of new collagen and ground substance down to a level in proportion to the depth of the peel. The peeling agent of choice is the Baker–Gordon phenol peel.

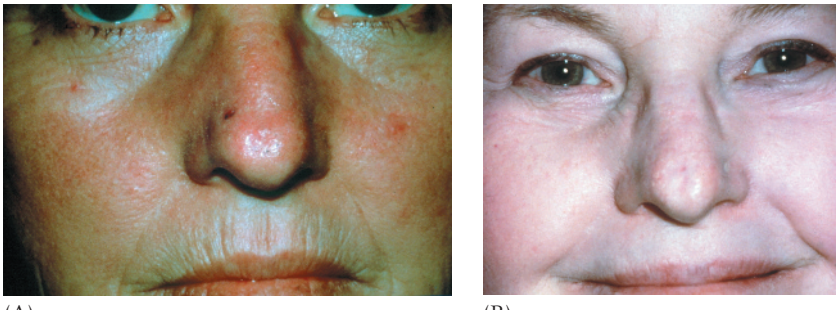
The Baker–Gordon peel utilizes phenol in a formulation that permits deep penetration into the dermis, deeper than full-strength phenol [16]. The Baker–Gordon formula consists of Septisol (Vestal Laboratories, St. Louis, MO), croton oil, and tap water added to a solution of phenol, reducing its concentration to 50% or 55% (Table 1.5). The mixture of ingredients is freshly prepared and must be stirred vigorously prior to application due to its poor miscibility. The liquid soap, Septisol, is a surfactant that reduces skin tension, allowing a more even penetration. Croton oil is a vesicant epidermolytic agent that enhances phenol absorption. Recent investigations into the effects of this peel using varying concentrations of both phenol and croton oil have suggested that the procedure's efficacy is related more to the amount of croton oil than to the phenol [17,18].

There are two main variations in deep chemical peeling with the Baker–Gordon phenol formula: occluded and unoccluded. Occlusion of the peeling solution with tape is thought to increase its penetration and extend the injury into the mid-reticular dermis. This technique is particularly helpful for deeply lined, "weather-beaten" faces but should be utilized only by experienced surgeons because of the higher risk of complications [19]. The unoccluded technique as modified by McCollough involves a more vigorous cleansing of the skin and the application of more peel solution [20]. This may enhance the efficacy of the solution, but without penetration as

Table 1.5 The Baker–Gordon formula.

88% liquid phenol, USP	3 mL
Tap water	2 mL
Septisol liquid soap	8 drops
Croton oil	3 drops

USP, United States Pharmacopeia.



(A) (B)

Figure 1.9 Advanced photoaging of perioral rhytides treated with Baker–Gordon phenol peel. (A) Preoperative appearance, demonstrating perioral rhagades, textural and pigmentary changes with epidermal growths. (B) Postoperative, two years later: note that the phenol peel maintains correction for many years.

deep as in an occluded peel. In the hands of a skilled and knowledgeable surgeon, both methods are safe and reliable in rejuvenating advanced to severe photoaged skin. Deep chemical peeling can significantly improve or even eliminate deep furrows as well as other textural and pigmentary irregularities associated with severe photoaging (Fig. 1.9). A remarkable degree of improvement is the expected result of deep chemical peeling when performed properly on carefully selected patients.

The patient undergoing deep chemical peeling must understand and be willing to accept the significant risk of complications and the increased degree of morbidity. The most notable complications include scarring, textural changes such as "alabaster skin" or "plastic skin," and pigmentary disturbances. It is not uncommon for patients to experience postoperative erythema that can take many months to resolve and may be followed by variable hypopigmentation (Fig. 1.10). Male patients and patients with darker complexions are less favorable candidates for deep chemical peeling, as the hypopigmentation is less easily camouflaged. Since phenol is cardiotoxic, preoperative evaluation includes a complete blood count, liver function tests, serum urea nitrogen and creatinine and electrolyte determinations, and a baseline electrocardiogram. Any patient who has a history

Figure 1.10 Complications from Baker–Gordon phenol peel with prolonged non-healing, resulting in hypopigmentation and marbled scarring.

of cardiac arrhythmias or who is taking a medication known to precipitate arrhythmias should not undergo a full-face Baker–Gordon phenol peel. Patients with a history of hepatic or renal disease are also poor candidates.

Compared with medium-depth and superficial peeling, the Baker–Gordon phenol peel is a time-consuming procedure, and it must be performed only in a properly equipped facility. The required waiting period after the treatment of each cosmetic unit limits the rate of cutaneous absorption, thereby preventing the serum levels of phenol from reaching a dangerous peak during the procedure. Intravenous hydration with a liter of lactated Ringer's solution before the procedure and another liter during the peel also promotes phenol excretion and prevents toxicity. Continuous electrocardiography, pulse oximetry, and blood pressure monitoring are mandatory during the entire perioperative period. Any abnormalities, such as a premature ventricular contraction (PVC) or premature atrial contraction (PAC), necessitate abrupt stoppage of the procedure and careful evaluation for toxicity [21]. Oxygen is supplemented throughout the procedure, as some physicians feel that it has a protective effect against cardiac arrhythmias.

After thorough cleansing and degreasing of the skin, the chemical agent is applied sequentially to six aesthetic units: forehead, perioral region, right cheek, left cheek, nose, and periorbital region. There is a 15-minute interval between the treatment of each cosmetic area, allowing 60–90 minutes for the entire procedure. Cotton-tipped applicators are used with a technique similar to that described for the medium-depth Jessner's + 35% TCA peel, although less solution is used because frosting occurs very rapidly (Fig. 1.11). Occlusion of the peel can be accomplished with strips of waterproof zinc oxide tape (e.g., half-inch Curity tape) to each cosmetic unit just after the phenol is applied. Care is exercised to extend the peel slightly beyond the mandibular rim, to conceal the demarcation between treated and untreated skin. The last aesthetic unit, the periorbital skin, is treated cautiously and conservatively to avoid over-penetration, which can lead to ectropion or scarring. It is important to remember that diluting a phenol compound with water may increase its penetration, so mineral oil rather than water should be used to flush the eyes if contact occurs.

Figure 1.11 Rapid frosting from small amounts of Baker's phenol solution applied with cotton-tipped applicators.

Application of the peeling agent creates an immediate burning sensation, which lasts for 15–20 seconds, subsides for 20 minutes, and then returns for the next 6–8 hours. Ice packs may be applied as necessary for patient comfort. Narcotics are usually prescribed upon discharge for adequate pain control. Systemic steroids are also administered by some surgeons to lessen the inflammatory response. For untaped peels, petrolatum is applied and a biosynthetic dressing can be used for the first 24 hours.

Conclusion

There are multiple instruments now available for resurfacing and retexturing photodamaged and aging skin. Although new fractional non-ablative and ablative lasers are appealing because of skin contraction and less downtime, non-ablative lasers can produce results very similar to light chemical peels, with minimal downtime. With these choices available, it behooves the cosmetic physician to be familiar with chemical peeling as a major tool in the practice. The medium-depth peel especially is a reliable procedure that is efficacious and safe for most patients. The results are individualized to each patient's needs, though the physician needs the training and experience to perform the procedure correctly.

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