Overview of Chemical Peeling Agents
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Overview of Chemical Peeling Agents, Part I
The following potential conflict of interest relationships are germane to my presentation.
There are no conflicts.

History of Chemical Peels
- Egypt: first evidence of exfoliant use
  - Sun-damaged skin was sign of low social ranking
  - Used sour milk, containing lactic acid
- Turks: used fire to produce a thermal exfoliation
- 1882: P.G. Unna, German dermatologist
  - Described resorcinol, salicylic acid, phenol, trichloroacetic acid peels
**History of Chemical Peels**

- **1903:** Dr. Mackee, chairman of Dermatology NYU  
  - Began using phenol for acne scarring
- **1961:** Drs. Baker and Gordon  
  - Presented phenol peel formula
- **1966:** Baker published results in 250 patients
- **1974:** Van Scott and Yu described effectiveness of lactic acid in treatment of dry skin

**Chemical Peel Definition**

- Skin treatment intended to visibly improve structure of treated tissue by external application of chemical solution
- Controlled wound of the skin

**Chemical Peels**

- Cause skin changes via the following mechanisms:
  - Stimulating epidermal growth through removal of stratum corneum
  - Destruction of specific skin layers, allowing them to become more normalized (organized) achieving a more pleasing appearance
  - Inflammatory reactions resulting in new collagen and ground substance production in dermis (deeper peels)
Classifications of Skin Type and Aging

- Fitzpatrick Classification
- Glogau Classification
- Rubin Classification
- Numerical Score of Photoaging

Fitzpatrick’s Classification

- I: very white, always burns
- II: white, usually burns
- III: white to olive, sometimes burns
- IV: brown, rarely burns
- V: dark brown, very rarely burns
- VI: black, never burns

Glogau Classification

- Type I: no wrinkles, not even with animation
- Type II: wrinkles in motion, freckling, brownish cast
- Type III: obvious wrinkles at rest, visible keratoses, sallow color
- Type IV: no unlined skin
Rubin Classification

• Level 1
  - Increased thickness of the stratum corneum
  - Dyschromias in epidermis: freckles, lentigines
  - Fine lines in superficial epidermis

• Level 2
  - Increased textural and pigment changes in the epidermis and papillary dermis
  - Actinic keratoses, senile lentigines
  - Wrinkling of epidermis and superficial dermis
  - Loss of collagen, elastin, and subcutaneous fat

Rubin Classification cont.

• Level 3
  - Cosmetic defects due to alterations in the epidermis, papillary dermis, and reticular dermis
  - Thickened leathery appearance
  - Deep wrinkles and folds
  - Progressive loss of collagen, elastin, and subcutaneous fat
  - Increased dyschromias and actinic keratoses

Numerical Score of Photoaging

• Developed by Drs. Monheit and Fulton
• The score relates to the recommendation of rejuvenation program
• Each of the 12 features of aging are given a score of 1-4
• Helps patients understand their recommendations
Classification of Peels

- Superficial-very light
- Superficial-light
- Medium depth
- Deep

Superficial-Very Light Peels

Wounding to the level of the stratum spinosum
- Tretinoin
- TCA 10-20%
- AHA low potency
- BHA
**Superficial-Light Peels**

Wounding through the epidermis
- TCA 20-30%
- Jessner solution
- 70% glycolic acid

**Medium Depth Peels**

Wounding to the level of reticular dermis or through the papillary dermis
- TCA 35-40%
- Jessner solution + TCA
- Glycolic+TCA

**Deep Peels**

Wounding to the mid reticular dermis
- Baker-Gordon
- Phenol
Peel Penetration

Chemical Peels

Substances are divided into three categories:

- Metabolic
- Caustic
- Toxic

Metabolic Substances

- AHAs
- Azelaic Acid
- Retinoic Acid

- These work by modifying cellular activity and can be moisturizing, bacteriostatic, antiviral, antiproliferant, cytotoxin, etc
Caustic Substances

- TCA

- This caustic substance works through an acidic PH which is neutralized as it progresses through the skin coagulating protein.

Toxic Substances

- Phenol
- Salicylic
- Resorcinol

- These work by cellular poisoning through enzymatic inactivation, protein denaturation, changes in membrane permeability. Systemic toxicity.

Chemical Peeling Agents

- Enzyme
- Glycolic Acid
- Lactic Acid
- Pyruvic Acid
- Salicylic Acid

- Resorcinol
- Jessner’s Solution
- Trichloroacetic Acid
- Phenol
- Combination Peels
Enzyme Peels

• Protein generally derived from fruits, vegetables, dairy, or animal origin that acts as a biological catalyst to accelerate or produce chemical change

Enzyme Mechanism of Action

• Digests cells of stratum corneum
• Accelerates skin renewal

Enzyme Peels

• Papaya
• Pumpkin
• Pineapple
• Mushroom
Enzyme Peel Benefits

- Stimulates new cell growth
- Exfoliates dead skin cells
- Improves skin tone and texture
- Alleviates dryness
- Reduce redness
- Reduce toxins
- Increase oxygenation
- Retextures flaky, scaly skin
- Clears pores
- Reduce pore size

Enzyme Peel Indications

- Acne skin with pustules and macules, especially on the back
- Removal of keratin build-up on the skin
- Adjunct to other treatments
**Enzyme Peel Contraindications**

- Possible allergic reaction
- Sunburn
- Severe erythema
- Accutane or any other skin sensitive medications

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**Alpha-Hydroxy Acids**

- Occur naturally in fruits and dairy products
- Possess carboxylic acid group (COOH) and hydroxy group (OH) in alpha position relative to acid group

\[
\text{HO} \quad \text{OH}
\]

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**AHA Sources**

- Lemon, grapefruit: citric acid
- Apples: malic acid
- Grapes: tartaric acid
- Sour milk: lactic acid
- Sugar cane: glycolic acid
AHA Mechanism of Action

- Alpha hydroxy acids reduce corneocyte cohesion, causing epidermal desquamation
- This causes rapid transformation of basal cells into keratinocytes, speeding their migration to the stratum corneum


AHA Mechanism of Action

- Stimulation of keratinocyte growth causes fibroblast proliferation and synthesis of dermal proteins (collagen, elastin, glycosaminoglycans)
- Note that alpha hydroxy acids must be neutralized to stop action and penetration

Glycolic Acid

- Alpha hydroxy acid derived from sugar cane; also synthesized chemically
- Has keratolytic, germinate layer, and fibroblast stimulating action
- Acts by thinning stratum corneum, promoting epidermolysis, dispersing basal layer melanin and epidermal and dermal hyaluronic acid and collagen gene expression

Glycolic Peel Delivery Systems

- Free glycolic acid solution
  - Non-neutralized acid solution
  - pH ranging from 0.6 to 1.7
  - Greater bioavailability and reactivity when applied to skin
- Partially neutralized
  - Combination of glycolic acid with base (ammonium hydroxide)

Glycolic Peel Delivery Systems

- Buffered
  - Solution that resists pH changes with the addition of an acid or base
  - No practical benefit in sole use as chemical peeling agent
- Esterified
  - Solution forming glycol-citrate
  - Occurs when ester bond forms between carboxyl group of glycolic acid and hydroxyl group of citric acid
**Glycolic Acid Indications**

- Dry skin
- Sun and environmentally damaged skin
- Acne
- Pigmentation
- Fine lines
- Rosacea
- Pseudofolliculitis barbae

**Glycolic Acid Contraindications**

- Accutane use within two years
- Herpetic breakout
- Open wounds
- Suspicious lesions
- Bleeding
- Pregnancy
- Cancer and/or cancer therapy
- Hepatitis
- Autoimmune disease

**Glycolic Acid Advantages**

- Very mild erythema
- Mild desquamation
- Short post-procedure protocol
- Useful in photodamage
- Can be used on all skin types
**Glycolic Acid Disadvantages**
- Burning sensation and erythema during application
- No uniformity of application
- Neutralization is mandatory
- Necrotic ulcerations if time of application is too long and/or skin pH is reduced
- Cautious application in patients with active acne

**Glycolic Acid Application**
- Can be applied in aqueous solution or gel using gauze pads, brush, swab, etc.
- Solution should be applied quickly (15-20 seconds) so contact time is the same for the entire face
- Apply to most resistant areas first (forehead) and more sensitive areas last (eyelids)

**Glycolic Acid Application**
- Contact time depends on appearance of erythema rather than concentration, pH, volume applied, etc.
- Erythema appears in spots, patches
Correlation between skin appearance & depth of AHA peel

- No erythema: virtual peeling effect
- Spots of erythema: very, very superficial
- Patches of erythema: very superficial
- Widespread erythema: superficial peel
- Frosting: too deep for AHA peel

Neutralization

- AHA peel should be neutralized as soon as erythema appears and before first pinpoint of frosting (protein coagulation) appear
- Solution of sodium bicarbonate
- Used only with unbuffered solutions
- Buffered solutions neutralized with water

Depths reached by unbuffered 70% glycolic acid (pH 0.5) as function of contact time

- 1-5 minutes: gradual deepening epidermolysis, depending on contact time and skin sensitivity
- 5 minutes: acid reaches dermoepidermal junction
- 10 minutes: acid reaches dermis, which is not desirable, as its effect locally will be similar to that of 30-35% TCA
- 15 minutes: depth of local skin necrosis is histologically comparable to or greater than that reached with 35-40% TCA
Glycolic Acid Side Effects

- Stinging
- Burning
- Itching
- Hyperpigmentation (rare)
- Infection (rare)

Glycolic Acid Results
Salicylic Acid

- Beta hydroxy acid
- Frequently used in topical acne preparations because of comedolytic effects

Salicylic Acid

- Facilitates penetration of other topical agents
- Used in 10, 20, 30% ethanol formulations
- Lipid soluble; penetrates easily into lipid plug of congested follicle
- Self-neutralizing

Salicylic Acid

Mechanism of Action

- Removes intercellular lipids that are covalently linked to cornified envelope
- Loss of corneocytes followed by activation of epidermal basal cells and underlying fibroblasts
- Possess anti-inflammatory and antimicrobial properties

Salicylic Acid Indications

- Sun damaged skin (actinic keratoses)
- Fine wrinkling
- Loss of elasticity
- Acne vulgaris
- Pigmentation abnormalities
- Rough, calloused skin
- Melasma

Salicylic Acid Contraindications

- Aspirin or salicylic acid sensitivity
- History of severe allergies
- Pregnant or nursing
- Accutane use within one year
- Topical or systemic antibiotics
- Broken skin
- Laser treatment within previous 12 weeks
- Application of glycolic acid products, Retin A within previous 4 weeks
Salicylic Acid Peel Advantages

- Established safety profile in patients with Fitzpatrick skin type I-VI
- Excellent in patients with acne
- Even application easily achieved due to appearance of white precipitate
- After several minutes peel induces anesthetic effect, increasing patient tolerance

Salicylic Peel Disadvantages

- Limited depth of peel- always superficial
- Minimal efficacy in patients with significant photodamage

Salicylic Acid Peel Application

- 20-30% salicylic acid in ethanol formulation
- Performed at 2-4 week intervals
- Apply using fan brush, gauze, or sponges
- Apply total of 2-3 coats of solution
- Solution left on for 3-5 minutes
- White precipitate, representing salicylic acid forms 30 seconds to 1 minute following peel application
- Face rinsed thoroughly with water after 3-5 minutes
Salicylic Acid Precipitate

Salicylic Pre-Peel Preparation

- Topical retinoids (tretinoin) 2-6 weeks prior to peeling to thin stratum corneum and enhance epidermal turnover
- Reduce epidermal melanin content
- Topical antibiotics and benzoyl peroxide to control acne
- All need to be discontinued one week prior to peel

Salicylic Post Peel

- Bland cleanser and moisturizer until post peel irritation subsides
- Topical steroids for excessive desquamation and irritation
Salicylic Peel Side Effects

- Erythema
- Dryness
- Crusting
- Salicylism (salicylic acid toxicity)
  - Rapid breathing
  - Tinnitus
  - Hearing loss
  - Dizziness
  - Abdominal cramps
  - Central nervous system reaction

Salicylic Acid Results

Jessner’s Solution

- Developed by Dr. Max Jessner to reduce side effects of resorcinol such as contact dermatitis, skin discoloration
- Superficial peeling agent consists of mixture of salicylic acid, resorcinol, and lactic acid in 95% ethanol
Jessner’s Mechanism of Action

- Jessner’s solution causes loss of corneocyte cohesion
- Induces intercellular and intracellular edema
- Induces wounding to the level of papillary dermis
- Each component of solution had specific effects

Jessner’s Mechanism of Action

- Salicylic Acid
  - Beta hydroxy agent
  - Lipophylic compound that removes intracellular lipids covalently linked to cornified envelope surrounding epithelial cells
  - Enhances penetration of other agents
  Lazo ND et al. Lipids are covalently attached to rigid corneocyte protein envelope existing predominantly as beta-sheets: solid state nuclear magnetic resonance study. J Invest Dermatol 1995; 105:296-300

Jessner’s Mechanism of Action

- Resorcinol
  - m-dihydroxy benzene
  - Structurally and chemically similar to phenol
  - Disrupts weak hydrogen bonds of keratin
Jessner’s Mechanism of Action

- Lactic Acid
  - Alpha hydroxy acid
  - Causes corneocyte detachment and subsequent desquamation of stratum corneum


Jessner’s Solution Formulation

- Resorcinol 14 g
- Salicylic acid 14 g
- Lactic acid (85%) 14 g
- Ethanol to make 100 mL solution

- Solution must be kept sealed in a dark bottle
Modified Jessner’s Solution

- Lactic acid 17%
- Salicylic acid 17%
- Citric acid 8%
- Ethanol to make 100 mL solution

- Solution must be kept sealed in a dark bottle

Jessner’s Solution Indications

- Acne
- Photodamaged skin and premature aging
- Lentigines (freckles) and actinic damage
- Hyperpigmentation
- Pre-peel for TCA
- Melasma
- Post-inflammatory hyperpigmentation

Jessner’s Solution Contraindications

- Allergies to resorcinol, lactic acid, or salicylic acid
- Hypersensitivity
- Active inflammation, dermatitis, or infection in treatment area
- Isotretinoin use within 6 months of treatment
- Delayed/abnormal wound healing
- Pregnancy
Jessner’s Solution Application

- Superficial, controllable peel that does not require dilution or neutralization
- Can be applied on face and body from 1 coat up to 10 coats dependent upon skin type, skin condition, and intended results
- Application performed with fan brush

Jessner’s Solution Application

- Will produce light to moderate peeling dependent upon the number of layers applied
- Depth of peel dependent upon skin preparation, stratum corneum thickness, and number of layers applied

Levels of Jessner Peels

- Level I
  - One layer Jessner solution
  - Produces superficial peeling during first three days
  - Mild erythemic response but no true frosting
  - Slight frost may be seen due to precipitation on skin of one of the chemicals in solution
  - 1-2 days mild flaking following peel
Level I Jessner Peel

Levels of Jessner Peels

- Level II
  - Created by application of 2-3 layers of solution with a 3-5 minute waiting period between coats
  - Skin develops mild red-brown color with noticeable streaking
  - Treated skin feels tight, like a mask
  - Exfoliation for 2-4 days, depending on depth of penetration

Level II Jessner Peel
**Levels of Jessner Peels**

- **Level III**
  - Created by application of 3-4 layers of solution with a 3-5 minute waiting period between layers
  - Shows prominent erythema and areas of true frosting
  - Skin appears white on surface
  - Exfoliation takes 8-10 days
- Additional layers produce more profound erythemic response, often turning form bright red to pink
- May be mild-moderate burning and stinging sensation

**Level III Jessner Peel**

![Image of Level III Jessner Peel]

**Jessner Peel Preparation**

- Bleaching agents 2-4 weeks prior
- Topical retinoids 2-6 weeks prior
- Alpha hydroxy acids 2-4 weeks prior
**Jessner Peel Post Care**

- Do not wash area for 24 hours
- Gentle cleansing, moisturizer, and sunblock permitted
- No sun exposure
- Avoid picking

**Jessner Peel Side Effects**

- Temporary acne flare up
- Hyperpigmentation
- Allergic reaction
- Infection

**Jessner Peel Advantages**

- Excellent safety profile
- Can be used in all skin types
- Substantial efficacy with minimal downtime
- Enhances penetration of TCA
Jessner Peel Disadvantages

- Concerns regarding resorcinol toxicity, including thyroid dysfunction
- Manufacturing variations
- Instability with exposure to light and air
- Increased exfoliation in some patients

Jessner Peel Results

Jessner Peel Healing Process

Trichloroacetic Acid (TCA)

- Use of TCA first described by P.G. Unna (German dermatologist) in 1882

Trichloroacetic Acid (TCA)

- TCA may be used for tissue penetration of superficial and medium depths depending on concentration
- Superficial peels achieved with 10-25% TCA concentrations
- Medium depth peels achieved with concentration of 35% TCA in combination with another agent
TCA Peel Mechanism of Action

- Chemical cauterant; agent that causes protein denaturation
- Destruction of living cells of epidermis and dermis (depending on acid concentration)
- Abnormal keratinocytes replaced by healthy cells from surviving islets of keratinocytes, pilosebaceous units, and sweat glands

TCA Peel Mechanism of Action

- As skin re-epithelializes, new collagen in formed
- Depth of skin necrosis directly proportional to TCA concentration

TCA Depth of Penetration

<table>
<thead>
<tr>
<th>LEVEL OF DESTRUCTION</th>
<th>TYPE OF ACTION</th>
<th>DURATION OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper stratum corneum</td>
<td>Exfoliation</td>
<td>Very temporary</td>
</tr>
<tr>
<td>Intraepidermal</td>
<td>Partial destruction of dermis</td>
<td>Very temporary</td>
</tr>
<tr>
<td>Basal layer</td>
<td>Destruction</td>
<td>Temporary</td>
</tr>
<tr>
<td>Grenz zone</td>
<td>Destruction</td>
<td>Medium duration</td>
</tr>
<tr>
<td>Papillary dermis</td>
<td>Destruction</td>
<td>Long lasting</td>
</tr>
<tr>
<td>Upper reticular dermis</td>
<td>Destruction</td>
<td>Permanent</td>
</tr>
<tr>
<td>Deep reticular dermis</td>
<td>Destruction</td>
<td>Permanent; scarring risk</td>
</tr>
<tr>
<td>Hypodermis</td>
<td>Destruction</td>
<td>Permanent scarring</td>
</tr>
</tbody>
</table>

**TCA Penetration**

- 10-20% TCA produces light superficial peel not penetrating below stratum granulosom
- 25-25% TCA produces light superficial peel with penetration encompassing full thickness of epidermis
- 40-50% TCA results in medium depth peel with injury to the papillary dermis

**TCA Peel Depth**

- > 50% TCA results in injury to reticular dermis
- TCA in concentrations greater than 35% produce unpredictable results and should be avoided
- Medium depth peel should involve 35% TCA in combination with another agent
**TCA Peel Indications**
- Epidermal growths including actinic keratoses and thin seborrheic keratoses
- Mild to moderate photoaging
- Pigmentary dyschromia including melasma, post-inflammatory hyperpigmentation
- Pigmented lesions including lentigines and ephelides
- Acne
- Acne scarring
- Fitzpatrick skin types I-III

**TCA Peel Contraindications**
- General run-down condition
- Epidermolysis
- Active bacterial, mycotic, or viral skin infections
- Severe progressive neoplastic disorders
- Immunodeficiency
- Insulin dependent diabetes
- Prior treatment with isotretinoin
- Keloid scars, if peel penetrates to papillary dermis
- Extensive telangiectasia

**TCA Peel Application**
- Sable brush provides deeper penetration than gauze or cotton-tipped applicators
- Divide area to be peeled: forehead, temples, cheeks, lips, eye area
- TCA does not need to be neutralized
**TCA Peel Application**

- Speed of application depends on
  - Patient sensitivity (should apply zone by zone)
  - Surface area being treated
  - Depth of peel
    - Intradermal peel: zone by zone
    - Intraepidermal peel: done at one time

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**Symptoms Following TCA Application**

- Erythema: peel is intraepidermal
  - Little or no risk of visible flaking
- Scattered pinpoint frosting: peel is near basal layer
  - Sunburn-type flaking
- Cloudy-white frosting: peel has reached Grenz zone
  - Flaking: light, thin skin

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**Symptoms Following TCA Application**

- Even pink-white frosting and “epidermal sliding”: TCA is in papillary dermis
  - Sliding (wrinkling) can be seen when skin is pinched, and corresponds to coagulation of anchoring fibers between dermis and epidermis
  - Flaking: more or less brownish skin, depending on phototype and photodamage
**Symptoms Following TCA Application**

- Pure white frosting: gradual disappearance of epidermal sliding
  - TCA has reached reticular dermis
- Gray-white frosting: epidermal sliding gone
  - TCA is in reticular dermis
- Gray frosting and/or yellowish patches indicates peel has reached deep reticular dermis
  - TCA should no longer be used for peels to deep reticular dermis

**TCA Application Endpoints**

- Scattered pinpoint and cloudy-white frosting signals most superficial peel to dermis
  - This is limit of effectiveness
- Even pink-white frosting signals a peel to deep papillary dermis
  - This is safety limit

**TCA Peel Classification**

- Results are dependent on multiple factors including type/thickness of skin, skin priming, and technique of application
- Level 0
  - No frost
  - Skin appears shiny, has a slick feel
  - Little frost or erythema
Level 0 TCA Peel

TCA Peel Level Classification

- Level 1
  - Irregular light frost
  - Erythema with blotchy areas of white frosting
  - Indicates superficial epidermal peel achieved with TCA concentrations < 30%

TCA Peel Level 1
**TCA Peel Level Classification**

- **Level 2**
  - Uniform white frost with pink showing through
  - White frosting with areas of erythema
  - Indicative of full-thickness epidermal peel to papillary dermis and can be achieved with TCA concentration > 30%
  - Results in full exfoliation of epidermis

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**TCA Peel Level 2**

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**TCA Peel Classification**

- **Level 3**
  - Solid white frosting; cannot see pink (no erythema)
  - Indicative of penetration of TCA through papillary dermis
  - Achieved with TCA concentrations > 30% depending on number of applications
TCA Peel Level 3

TCA Peel Preparation

• Broad spectrum UVA and UVB sunscreens
• Tretinoin 0.05-0.1% which is most critical component of regimen
  – Decreased stratum corneum thickness
  – Increases kinetics of epidermal turnover
  – Decreases corneocyte adhesion

TCA Peel Preparation

• Exfoliants such as glycolic acid or lactic acid result in decreased corneocyte adhesion and stimulate epidermal growth by disrupting stratum corneum
• Bleaching products such as hydroquinone 4-8% are useful in patients with Fitzpatrick skin types III-IV
Reactions to TCA Peels

• Very superficial epidermal peel
  – Tightness
  – Mild erythema
  – Flaking for 2-4 days
  – Use mild emollient moisturizer
  – Make-up may be worn
  – Do not rub or pick at skin

• Superficial, full-thickness epidermal peel
  – Skin turns dark and unsightly for 4-6 days
  – Clients must avoid sunlight
  – Skin feels tight and dry
  – Apply moisturizer every 1-2 hours so that skin does not crack
  – Skin must be kept moist to avoid danger of bacterial infection
  – Do not pick or scratch skin

• Papillary dermal peel
  – Skin is dark and unsightly for 5-8 days
  – May be some mild swelling for first 48 hours post peel
  – Head should be kept level while sleeping
  – Make-up should not be worn
  – Patient should stay home until completely healed
  – Cold compresses are recommended
**TCA Peel Side Effects**

- Infections: bacterial, viral, fungal
- Pigmentary changes
- Prolonged erythema milia
- Acne
- Scarring

**TCA Peel Advantages**

- Low cost procedure
- Uniformity of application and penetration
- Depending on frost, it is easily manageable with different concentrations

**TCA Peel Disadvantages**

- Stinging and burning sensation during application
- High concentrations are not recommended in skin types V-VI
- Hypo/hyperpigmentation can occur
Efficacy of Treatment with TCA

- Excellent to good response
  - Actinic keratoses
  - Superficial melasma
  - Superficial hyperpigmentation
  - Ephelides
  - Lentigines
  - Depressed scars

- Variable response
  - Seborrheic keratoses
  - Hypertrophic keratoses
  - Mixed melasma
  - Mixed hyperpigmentation

- Poor response
  - Thick seborrheic keratoses
  - Deep melasma
  - Deep hyperpigmentation

TCA Peel Results
TCA Peel Results

TCA Combination Peels

- Solid CO₂ and 35% TCA
- 70% glycolic acid and 35% TCA
- Jessner’s solution and 35% TCA
- Salicylic acid and TCA
- Modified TCA

Brody Combination

- Solid CO₂ and 35% TCA
- Medium depth peel
- 1986 Brody and Hailey reported satisfactory results from application of solid carbon dioxide, followed by 35% TCA, to enhance penetration of TCA
- Solid CO₂ creates epidermal injury without risk of deeper dermal freeze, hypopigmentation, or scarring
**Brody Combination**

- Neocollagen formation in subepidermal/dermal region and midreticular dermal band consisting of collagen and elastin fibers
- Penetrates upper reticular dermis, wound depth similar to full strength phenol

**Brody Combination**

- Disadvantages
  - Solid CO₂ produces edema with poorly defined boundaries at application site that can result in uncontrolled deeper penetration
  - Solid CO₂ destroys melanocytes leading to hypopigmentation
  - No clear endpoints for using solid CO₂ with TCA

**Coleman Combination**

- 70% glycolic acid applied before application of 35% TCA
- Believed to allow TCA to frost more evenly and to penetrate deeper
- Histology shows effects similar to medium depth peels
Monheit Combination

- Jessner’s solution applied followed by application of 35% TCA
- Jessner destroys epidermal barrier function by breaking intercellular bridges between keratinocytes
- Jessner’s solution removes stratum corneum, allowing TCA to penetrate to papillary dermis, leading to formation of new collagen that clinically decreases wrinkles and improves skin texture

Grimes Combination

- Salicylic acid (20-30%) followed by 10% TCA application
- Salicylic acid produces desquamation of stratum corneum via removal of intercellular lipids
- Enhances penetration of TCA
- In 2002, Grimes reported 70% significant improvement in hyperpigmentation using salicylic/TCA combination

Modified TCA

- Obagi Blue Peels
  - 15-20% TCA
  - Nonionic base
  - Glycerin
  - Plant saponins (slows acid penetration)
  - Blue dye (uniformity of acid application)

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**Modified TCA**

- Properties of modified TCA
  - Penetrates more slowly than unmodified version
  - Clinical depth signs develop more slowly, allowing time for recognition
  - Neutralized by skin more effectively
  - Intensity and duration of burning sensation are decreased
  - Less irritating to skin

**Jessner/TCA Combination**

[Images of before and after treatments]
Modified TCA

Phenol

Phenols are compounds in which a hydroxy group is attached to a benzene ring
- Made originally from coal tar; now made by hydrolyzing chlorobenzene

Phenol Formulations

- Baker-Gordon
  - Phenol, USP 88% 3 ml
  - Distilled water 2 ml
  - Septisol liquid soap 8 drops
  - Croton oil 3 drops
**Phenol Formulations**

- **Venner-Kellson**
  - Concentrated Lysol: 1 oz.
  - Olive oil: 0.5 oz.
  - Distilled water: 1.5 oz.
  - Croton oil: 10 drops
  - Melted phenol crystals: 8 oz.

- **Brown**
  - Phenol: 60-95%
  - Saponated cresol: 0.3%
  - Olive oil: 0.25%
  - Distilled water: ad 100%

- **Litton**
  - Phenol crystals: 1 lb.
  - Distilled water: 8 cc
  - Glycerine: 8 cc
  - Liquefied phenol: 4 oz.
  - Croton oil: 1 cc
Phenol Mechanism of Action

- Produces complete epidermolysis in keratinocytes
- Epidermal layer dissolved to basal at 24-36 hours post peel under occlusion
- Melanocytes become partially incapacitated in basal layer

Phenol Mechanism of Action

- Fibroblast activity observed in papillary dermis, mid-dermis, deep dermis, and hypodermis
- Wrinkled superficial layers liquefied and replaced by new tissue
- Better quality collagen rebuilt
Phenol Metabolism

- 25% metabolized into water and carbon dioxide and eliminated directly through lungs
- 75% eliminated in free and conjugated form or undergoes oxidation and is eliminated by the kidneys

Phenol Peel Concentration

- Solutions with high phenol concentration cause rapid protein coagulation, causing immediate frosting of the skin
- Coagulations acts as a shield that increases skin impermeability, stops surface phenol penetration, preventing it from passing into the reticular dermis

- Solutions with concentrations > 80% produce more superficial peels
- Solutions with lower concentrations (15-20%) are keratolytic and penetrate skin more easily to depth where the phenol s transferred to body rapidly for metabolization
Phenol Peel Indications

- Dyschromias
- Deep wrinkles
- Wrinkles around mouth & eyes
- Skin elastoses
- Lentigines
- Melasma
- Post-inflammatory hyperpigmentation
- Keratoses
- Acne scars

Phenol Peel Contraindications

- Insulin-dependent diabetes
- Active herpes
- Immunodeficiency
- Pregnancy
- Lactation
- Pre-existing heart condition
- Liver or kidney disease
- Keloid history
- Isotretinoin use
- Risk of dyschromia

Phenol Peel Treatment Approach

- Peel should take a minimum of 1 hour (90 minutes preferred) to avoid rapid absorption of phenol
- Face divided into zones so that procedure takes 90 minutes
  - Zone I: forehead and upper lid
  - Zone II: right cheek and lower lid
  - Zone III: left cheek and lower lid
  - Zone IV: nose, lips, chin
  - Zone V: neck
- Each zone is peeled, wiped lightly and occluded with waterproof tape (when indicated) before proceeding to next zone
Application of Phenol Peels

• Light Phenol Peel
  - Application: dry
  - Time: 15 seconds- 1 minute
  - Color seen: pink-white translucent frost
  - End treatment: aquaphor ointment keeps area moist until healed
  - Look for: forms yellow fibrinous exudate for few days while re-epithelializing beneath
  - Heals in 3-6 days

Phenol Frost Level I

Application of Phenol Peel

• Medium Phenol Peel
  - Application: dry
  - Time: 1-2 minutes
  - Color seen: white opaque for 15-20 minutes before turning red
  - End treatment: blot dry with gauze; apply thymol iodide powder every 24 hours for 8 days or apply aquaphor ointment immediately
  - Look for: becomes dry eschar with swelling and healing in 6 days or leave powder on for 6-8 days and remove with mineral oil
**Phenol Frost Level II**


**Application of Phenol Peel**

- Deep Phenol Peel
  - Application: wet
  - Time: 1-5 minutes
  - Color seen: gray-white with brown pigment showing through then turns red in 20 minutes
  - End treatment: may cover white frost with tape, one section at a time while waiting for phenol to absorb and metabolize. Tape off after 48 hours; thick coagulum partially removed and powder mask applied for 8 days; vaseline to remove powder mask at day 9; resume normal skin care routine

**Phenol Frost Level III**

Phenol Frosting

Phenol Peels

- Full face phenol peels should be carried out under full cardiopulmonary monitoring with intravenous hydration as well as intravenous sedation and/or regional blocks for pain
- Phenol peels require experienced and advanced techniques and should not be attempted without undergoing a supervised preceptorship with an experienced physician

Phenol Peel Preparation

- Debate as to whether skin preparation is necessary
  - Some use topical retin-A daily 3-6 weeks prior to peel to create more even penetration of solution
- Pre peel medications/topicals
  - Strong analgesic
  - Benzodiazepine
  - Acyclovir
  - Phenergan
  - Artificial tears eye drops
  - Sterile vaseline
  - Camouflage make-up
Post Phenol Medications

- Meperidine HCl
- Diazepam
- Flurazepam
- Valacyclovir
- Dicloxacillin
- Methylprednisolone dose pack

Post Phenol Care

- Following mask removal
  - Diprolene cream on day 10
  - Resume hydroquinone 4%, retin a 0.1% at 3-4 weeks post peel for hyperpigmentation

Phenol Peel Advantages

- Useful in patients with photodamage
- Useful patients with perioral wrinkles
- Useful in patients with atrophic scars
- Useful for facial skin rejuvenation
Phenol Peel Disadvantages

- Cardiotoxicity
- Hypopigmentation
- Demarcation lines

Phenol Peel Complications

- Cardiac arrhythmia
- Pigmentary changes (hypopigmentation)
- Scarring
- Infection
- Milia
- Acneiform dermatitis
- Skin atrophy

Phenol Peel Results
Phenol Peel Results

Phenol Peel Results