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Review: Efficacy and Safety of Chemical Peels In Cosmetic Dermatology

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Abstract

Peels made by chemicals are becoming increasingly popular in dermatology because of how well they work to cure a wide range of dermatoses and regenerate skin. This page provides thorough coverage of the classification, mechanisms of action, and therapeutic applications of chemical peels, including deep, medium, and superficial peels. We look at the roles played by several chemical agents, such as beta, alpha, and trichloroacetic acid. stressing how well they work to treat acne, improve skin texture, and lessen hyperpigmentation. To help guide clinical treatment, safety profiles, possible side effects, and contraindications are presented. In order to maximise results, focus is placed on the significance of patient selection and post-procedure care. The results highlight chemical peels' adaptation as a useful instrument in both therapeutic and cosmetic dermatology.

Keywords - Chemical peeling, superficial peels, medium peels, deep peels, alpha hydroxy acids, trichloroacetic acid, peeling methods, dermatology, and skin therapy.

INTRODUCTION

Chemical peels are treatments that remove certain skin layers chemically, causing the skin to regenerate into a rigid, even layer. During the actual peeling process, a caustic chemical is applied to the skin to remove layers, which are subsequently naturally eliminated over a few days, inducing dermal and epidermal healing mechanisms. Even when peeling is restricted to the epidermis, the mechanical action of the peel can promote regeneration through poorly recognised routes in the dermis. The material employed and its concentration determines how deep the harm goes. Systematic and scientifically verified method has only recently surfaced. One of the most common skin disorders, acne affects most ethnic populations [1] 85% to 90% of teenagers have acne, which can last into adulthood [2]. The way a person looks and self-confidence can be severely impacted by vulgaris acne, which can lead to fear, hopelessness, a low life satisfaction and even suicidal ideas [3]

Scars on the surface of the body from vulgaris acne can be divided into two categories: inflammatory and non-inflammatory. Topical medications like benzoyl peroxide, systemic medications like retinoid and oral antibiotics, and physical therapies like chemical peeling and laser therapy are all applied to acne disease. A typical skin-resurfacing technique for improving facial appearance and attractiveness is chemical peeling [4].It results in a controllable skin damage, which stimulates the dermal tissues to regenerate a new layer of epidermis [5]. The acid working together with the kind of vehicle, absorption and skin contact duration both have an impact on the depth of injury. Peels that are chemical can be classified as deep (Destruction part of the Retinal dermis that is mild), moderate (Destruction the upper reticular Skin layer and papillary epidermis), or superficial (damaging the epidermis) [6].

Chemical peeling is a popular cosmetic therapy for skin pigmentation, sun damage, and lentigines, with being frequently used to treat acne. While Peels that are superficial are usually Utilised to treat Wrinkles acne, Peeling deeply are primarily utilised to repair Marks from Acne.

The prevalent dermatological disorder acne vulgaris has an effect on an individual's psychosocial health in addition to its physical health symptoms. This review analyses the complex ways that acne affects mental health, social interactions, and self-esteem, as well as the critical role that psychological assistance plays in easing these difficulties. The noticeable appearance of acne on the face and body frequently sets off a series of emotional reactions, with self-esteem taking the brunt of these reactions. As they manage social and professional environments, both young people and older people may struggle with emotions of humiliation, shame, and self-consciousness. These feelings are made worse by today's society's constant emphasis on beauty, which increases acne's psychological cost [7]

History

In the Ebers papyrus, Egyptian physicians recorded the first application of acidic mixtures for peeling treatments as early as 1550 BC [8]. France developed the usage of phenol following World War -I [9]. Although MacKee had previously experimented with phenol treatment for scars in England, his findings were not published until 1952 [10]. Wolff and Eller supplied the initial complete account of 1940s US scar therapy practices involving CO, salicylic acid, phenol, and resorcine [11].

When Baker and Gordon created modified phenol solutions in the 1960s by adding croton oil, septisol, and water, the contemporary era of peeling got underway [12], as well as the comparison of TCA and phenol peels for the histological evaluation of peeling outcomes [13 ,14]. Alpha-hydroxy acids (AHA) were created at the same time by Yu and van Scott as superficial removing for inflammation [15]. Most widely used AHA, glycollic acid, was then produced for use in peeling [16]. The overviews of Brody and Haily's and Monheit's combinations of two superficial exfoliants—Jessner's solution 35% [17] TCA—in order to produce medium-depth effects furthered the development of Classification [18]. Utilising lipo-hydroxy acid is the most recent innovation (LHA) [19].

Classification of Chemical Peel

Types	Level of the penetration	Agents for peeling	Conditions
Superficial	60μm from stratum corneum to papillary dermis	Resorcinol, Lipohydroxy acid, Retinoic acid, TCA <20%, Unna paste, 5-fluorouracil, carbon oxide snow, beta hydroxy acids (salicylic acid 10–30%), glycollic acid (20–70%), Lactic acid, Malic acid, Pyruvic acid, and Tartaric acid.	Pigmetary disorder (melasma, moderate dyschromia, post-inflammatory hyperpigmentation), acne vulgaris, mild acne scarring, and mild photoaging (actinic keratose, fine line, roughness, solar leucite, yellow stains)
Medium depth	Upper reticular dermis to papillary dermis distance: 450μm	TCA 35–50% TCA 35% + solid carbon dioxide, TCA 35% + 70% glycollic acid, TCA 35% + solid carbon dioxide, and TCA 35% + Jessner solution.	Actinic keratose, fine lines, rhytides, solar lentigines, and mild-to-moderate dyschromia are associated with mid-moderate photoaging. atropic superficial scars

Deep	600µm to the mid reticular dermis	Gordon's backer, TCA >50%	Pigmetary disease, severe photoaging [21]"

Table 1*: *Classification of Chemical Peel

Mostly Used Ingredients

Agent For Superficial Peeling

Acid alpha-hydroxy

Class of carboxylic acids known as alpha hydroxy acids (AHA) is made up of compounds that have a hydroxyl group linked to the carboxyl group at the alpha position [20]. These acids are found in fruits [21]. AHA reduces corneocyte adhesion at lower doses. It encourages epidermolysis at greater dosages [22] AHA must be neutralised in order to stop acting. H_2O, NaOH, $NaHCO_3$ can be used to do this.AHA do not cause a trend of freezing [23]. One of the most widely used AHA stripping enzymes is GA. Acid solutions that are buffered, partially neutralised, esterified, or free are all available [24] Glycollic acid is soluble in water and has a pKa of 3.83. pKa is a basic concept in chemical stripping. 50% free acid is present in the solution at this pH Stronger peels are indicated by lower pKa values, which also signify increased free acid availability [25].

Acid beta-hydroxy

Salicylic acid

The willow bark, sweet birch, and winter green leaves are good sources of the SA is a naturally occurring beta hydroxy acid that is also referred to as ortho-hydroxybenzoic acid. It has poor water solubility with a pKa of 2.97. Salicylic acid differs from AHA in that it has a -OH group at the location of the second C-atom. It eliminates the interstitial lipids that have a covalent connection to the cornified keratinocyte membrane accordingly, the corneum stratum desquamates and low-level fibroblasts and keratinocytes become activated. SA is antibacterial, keratolytic, comedogenic anti-inflammatory and mild analgesic qualities. For superficial chemical peeling, salicylic acid is diluted Ten to thirty percent in PEG, or hydroethanolic baseline After applying dermis for three to five minutes, there is a brief burning sensation that is followed by the analgesic effects A white precipitate that is sometimes confused for coating is left behind after the hydroethanolic base evaporates It's vital to remember that peels containing salicylic acid don't cause sweets or need to be neutralised. In addition, if they are applied to a lot of surface area at once, there is a theoretical risk of salicylism Peels with salicylic acid are preferred for oily skin, comedonal acne, and inflammatory acne [26].

Pyruvic acid

Acetyl formic acid, often known as Unlike the American Heart Association, the acid pyruvic is an α-keto compound because it has a C = O group instead of a group of carboxyls With pKa of 2.39, it is a strong peeling agent that dissolves in both ethanol and water. 40% to 70% of pyruvic acid is utilised, and it is physiologically transformed to lactic acid Reduced epidermal thickness is the result of dermo-epidermal separation and ablation of the corneum stratum Enchanced papillary Collagen in the skin, elastic fibre, and glycoprotein deposition are among the long-term consequences When applied, pyruvic acid produces excruciating pain, and its fumes are strong and irritating [27].

Acid Lipohydroxy

C8-lipohydroxy acid is sometimes referred to as capryloyl salicylic acid, is made up of an eight-carbon acyl fatty chain that is joined to the benzene ring's fifth carbon[28] . To evenly divide corneocytes, lipohydroxy acid targets the protein structures known as corneodesmosomes.

It works more selectively in the epidermis and glandular follicle than salicylic acid does, and because of its increased lipophilicity, it has a greater keratolytic effect Lipohydroxy acid does not need to be neutralised when used in amounts between 5 and 10%. Moreover, it has non-comedogenic, anti-inflammatory, and antibacterial qualities [29].

Solution Jessner

The solution Jessner consists of 14 gm of SA, 14 gm of Resorcinol, 14 g of Acid lactic (85%), and 100 millilitre quantities sufficient of ethanol. To avoid photo-oxidation, this clear, amber-colored solution must be stored in a brown bottle. Usually, two to three applications of Jessner solution are needed before moderate erythema and delicate, spotty coating appear. It does not require neutralisation. This peeling agent may cause a burning sensation in certain patients. It can be applied as a pre-peel to improve another peeling agent's penetration, such TCA [30].

Resorcinol

One derivative of phenol is resorcinol. It is soluble in ether, alcohol, and water, with a pKa of Resorcinol breaks keratin's hydrogen bonds and promotes the production of prostaglandin E2. Its keratolytic and antibacterial qualities can be explained by this. Resorcinol causes a coating pattern when used at quantities between 10% and 50% for chemical peeling [31]. It is applied on melasma, acne, scars from acne, and some types of nodules Resorcinol side effects include myxoedema and chromosomal from extended use, sensational and irritating contact dermatitis, and hemoglobinemia [32].

Procedures

Consultation

A specialist assesses issues and skin type.

PreparationAfter cleansing, the skin may be readied using particular products.

Application

An even layer of the selected peeling agent is applied.

Neutralisation

The peel may be neutralised after a predetermined amount of time or allowed to self-neutralize, depending on the agent.

After-Treatment Care

Patients are usually given aftercare instructions and a calming substance is used.

Post Peel Care

Apply moisturisers and mild cleansers. Use broad-spectrum sunscreen and limit your exposure to the sun. Observe any particular advice given by the practitioner.

Risk and Side Effect

Little stinging, redness, or irritation. Transient dryness and peeling.

Figure1*: *Superficial Peeling

Medium-Depth Peeling Agents

TCA

Tricholoroacetic acid is hygroscopic, deliquescent crystal form of carbonic acid. It is hydrophilic and has a pKa of 0.26.42 TCA destroys the upper dermis and precipitates epidermal proteins.

It is combined to the proper concentration with distilled water and then dissolved w/v for chemical peeling This clear, colourless solution keeps best for up to six months when kept in an amber-colored glass bottle. TCA has not been linked to systemic toxicity or allergic responses, and it is not neutralised Use it on its own or in conjunction with other medications [33].

Indication

Sun Damage

Enhances skin texture and lessens pigmentation.

Wrinkles & Fine Lines

Promotes the formation of collagen.

Acne Scars

Reduces the visibility of scars.

Skin Texture

Encourages exfoliation, which enhances the general quality of the skin

Procedure

Preparation

Topical anaesthetics or, if required, sedation is typically used to prepare the skin.

Application

A brush or cotton applicator is used to apply TCA to the skin.

Depth Control

The strength of the peel can be controlled by varying the TCA content, which is typically 20%–40%.

Neutralisation

The peel may or may not be neutralised, depending on the strength and desired depth.

Post-Peel Care

Downtime

For roughly 5-7 days, there will be some redness, peeling, and sensitivity.

Moisturization

It's important to keep the skin moisturised.

Sun Protection

To avoid difficulties, strict avoidance of sun exposure is necessary.

Risk and Side Effects

Hazards and Adverse Reactions Hyperpigmentation

In darker skin types, particularly improperly handled.

Scarring

Infrequent, but conceivable with the wrong method or aftercare.

Infection

Could happen if there is insufficient post-peel care.

Figure 2*: *Depth-Medium Peeling

Deep Peeling Agents

Phenol

Carbolic acid or hydroxybenzene are common names for phenol (C H OH), The pKa of this aromatic hydrocarbon is 9.99.43. It is a pure crystal that is derived from coal tar Liquid phenol USP, a mixture of 88% phenol and 12% water, is used for chemical peeling. The concentration and surface area at which phenol is administered determine its physical effects. Phenol rapidly and irreversibly denaturates and coagulates proteins and epidermal keratin at concentrations greater than 80%. Through this process, shield that stops the agent from peeling from entering the deepest layers is formed [34]. On the other hand, phenol acts as a keratolytic agent when diluted to a 50% concentration It breaks down sulphur bridges, which permits phenol to enter the dermis deeper and cause more damage and systemic absorption Lipophilic phenol enters the bloodstream through the epidermis and is quickly absorbed Improper usage of this medication can lead to serious negative consequences such hepatotoxicity, kidney failure, and heart arrhythmias. Thus, they are an agent that could be hazardous [35]

Baker-Gordon Information

88% phenol (USP; 3 milliliter), three guttae of croton oil, eight guttae of septisol soap and two millilitres of distilled H_2O make up the Baker-Gordon recipe. To enable phenol to penetrate and be absorbed more thoroughly, a vesicant known as "croton oil" is prepared from the Aloe tiglium seed plant. Hexachlorophene is a liquid soap that functions as an emulsifier, raises surface tension, and inhibits the entry of phenol. It counteracts the drying and irritating properties of croton oil and phenol [36].

Procedure Overview

Preparation

Cleaning and maybe a pretreatment routine are used to prepare the skin.

Application

After applying the agent, the depth is observed. A scorching feeling may strike patients.

Post-Peel Care

In order to encourage healing and lower the risk of complications, patients need to adhere to precise aftercare procedures.

Risk and Side Effects

Hyperpigmentation

Especially in skin types with a darker tone.

Scarring

Stronger peels carry a higher risk of scarring, particularly if done incorrectly. If the recommended aftercare is not followed, infection

Figure3*: *Deep Peeling

Common Qualitative Test For Chemical Peels

PH Testing
Visual Observations
Patch Testing
Skin Reaction Assessment
Histological Examination
Patient Feedback

Peeling Techniques

Location, Personnel, and Equipment

Chemical peeling requires a dedicated procedure area with access to oxygenation equipment, enough ventilation, and light conditions. The patient should be accompanied by a the aid supervise the instruments, clean away sweat from the medialcanthal areas in order to prevent the peel agent from unintentionally entering back into the person eye. A person must never be left alone while treatment is being done. It is recommended to prepare the peeling agent as per the product specification, otherwise to inspect and store it in a little, clearly labelled glass container away from the patient. The stripping agent needed to never be given to the patient and should always be stored in a secure location in case of accidentally harm. It is necessary to have ocular irrigation solutions and neutralising agents such glycerine, saline, or water on hand. It is necessary to follow by regional infection control policies and occupational health and safety procedures. Throughout the process, glasses must be worn [37]

Patient

Patients should be sitting in a lying position with a towel draped over their neck and their head put up on a cushion at a 45-degree angle while undergoing chemical peeling of the face. They should keep their eyes shut throughout the process, if required, protective gear for the eyes should be provided. Hair bands or surgical caps are used to keep hair away from the area being treated. Use petroleum jelly or zinc oxide paste to prevent the peeling agent from pooling in the Mediam canthi, nasolabial wrinkles, genital commissures and cheeks. An essential component of patient care is the management of pain and anxiety. This can be finished with a variety of techniques, including general anaesthesia, regional nerve blocks, oral medications and physical techniques like air and cold packs. It is typically not required to undergo anaesthesia for superficial peels, but it is frequently necessary for phenol peels to be done under relaxation or regional or general anaesthesia [38].

Complication

Minor

After the treatment, minor issues could happen minutes or hours later. These include of burning, swelling, inflammation, itching, and irritation [39]. Additionally, small issues also appear gradually over a few days to a few Week [40]. Among these include the development of viral, bacterial, and fungal infections; chronic inflammation; separation scars; and sores. There may also be textural alterations, hyperpigmentation and hypopigmentation, atrophic, hypertrophic, and keloid scarring, as well as enhanced naevi pigmentation [41].

Major

The main, still uncommon, local and systemic effects related to acute damage to the kidneys, irritation of the inner lids, ocular harm, severe scarring, toxic shock syndrome, tracheal swelling,, salicylism, allergic responses are examples of chemical peeling [42]

New Development and Future Goals

In recent times, there has been a growing trend of premium or luxury peels. Together with conventional peeling agents (such TCA, AHA, and beta hydroxy acid), these solutions contain a range of vitamins, extracts from plants, and other active components that can be used in a unique topical administration system [43]. Although isn't much data to support the superiority of boutique peels over standard peels, their popularity in the chemical peel business has grown due to their better marketing, cobranding with cosmetic product lines, and more focus on improving the patient experience. Additionally, there is a growing tendency in the use of superficial peels as maintenance therapy following fractional rejuvenation and strong pulsed light operations. Together with knowledgeable nurses and therapists, patients can design a maintenance skin care routine that combines in-clinic peels and at-home cosmetics [44].

Ideal Characteristics

It needs to be nontoxic and nonirritating

It has to be chemically and physically stable.

There should not be any dirt in it.

Its smell should be pleasant [45]

Applications

Acne Treatment

By exfoliating the skin and clearing blocked pores, chemical peels—especially ones with salicylic acid—help reduce acne.

Hyperpigmentation

Peels can effectively lighten dark spots and even skin tone by increasing skin cell regeneration.

Fine Lines and Wrinkles

Glycollic acid and other alpha-hydroxy acids (AHAs) encourage the production of collagen, which enhances Surface of the Skin and decreases an indication of ageing

Sun Damage

Healing UV-damaged skin, peels can enhance a person's overall attractiveness.

Melasma

By encouraging exfoliation and lowering pigmentation, certain peels can help treat melasma, a disorder that results in dark areas on the skin.

Skin Texture and Tone

Peels improve the radiance and smoothness of the skin, which makes them a popular procedure for overall regeneration of the skin.

Psoriasis and Keratosis

By promoting peeling and lowering scaling, certain peels can help with managing this disorder.

Scar Treatment

By promoting skin regeneration, peels can help superficial scars seem better.

Chemical peels are an excellent tool in dermatological treatment since they are generally adaptable and may be customised to specific skin types and issues [46].

Safety Considerations

Patient Selection

The greatest prospects are those with specific skin types and problems; those may be more susceptible to post-inflammatory hyperpigmentation if they have darker skin tones [47].

Pre-treatment Evaluation

It's essential to accurately find out the skin kind of the patient, medical history, present skin-related issues. Possible adverse effects include redness, swelling, peeling, and in rare cases, infections or scars.

Post-treatment care

Crucial for reducing hazards and may involve moisturising and sun protection [48].

Efficacy

Short-Term

Visible improvements from superficial peels frequently appear in a few days, and immediate effects may include better texture and tone [49].

Long-Term

Constant improvement after multiple treatments; longer-lasting effects can be obtained but more recovery time is needed with deeper peels. Conditions Treated: Good for sun damage, wrinkles, acne, and skin cancer [50].

CONCLUSION

Chemical peels are a well-established dermatological treatment, displaying great efficacy in resolving a range of skin issues, including acne scars, hyperpigmentation, and photoaging. Selecting a peel type—deep, medium, or superficial—affects the safety profile as well as the results. Superficial Peels: Good for minor skin flaws, with little recovery time and little chance of problems. Deep and medium peels: Better for more serious skin problems, such as large-scale sun damage and deeper wrinkles. They take longer to recover from, but they yield more noticeable effects. In most cases, chemical peels are safe when done by qualified experts. But there's a chance of side effects like erythema, post-inflammatory hyperpigmentation, and, in extreme circumstances, scarring. Pre-procedure counselling and post-procedure care are essential for reducing risks and improving results. In summary, chemical peels are a variety of and effective therapeutic option in dermatology, with a tolerable safety profile when performed carefully. The safety and effectiveness of these products have been further improved by ongoing developments in methods and formulations.

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