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Original Research Article

To evaluate role of combination peel (15% TCA and 8% Phenol) in superficial nail plate abnormalities

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Abstract

Background: Superficial nail abnormalities, including conditions like nail psoriasis, idiopathic trachyonychia, and nail lichen planus, present significant therapeutic challenges leading to cosmetic concerns.
Aims & Objectives: To evaluate the efficacy of medium depth chemical peel, specifically a trichloro-acetic acid (TCA) 15% with phenol 8% combination, to target superficial nail issues, thereby improving the overall appearance and texture as a conservative management strategy.
Materials and Methods: We conducted an open-label uncontrolled prospective study at a tertiary care centre from September 2024 to January 2025. Total 31 subjects meeting the inclusion and exclusion criteria were recruited after obtaining informed consent. The treatment involved applying the chemical peel to affected nails over multiple sessions after protecting cuticle. Objective assessment of severity was conducted using the newly devised Nail Surface Abnormality Index (NSI). Patient-perceived severity was measured using the Visual Analogue Scale (VAS), while physician-assessed severity was determined using Physician's Global Assessment (PGA) scores.
Results: From the 31 patients originally recruited, 28 completed the study and were included in the final analysis. Three patients withdrew prior to completion due to reasons unrelated to the research. The mean NSI score improved significantly from 5.47 at baseline to 2.05 after 12 weeks, while the VAS score decreased from 6.25 to 2.49, indicating a 62.5% improvement in NSI and 60.2% in VAS scores. According to the PGA score, nine patients (46.43%) showed good improvement, while eleven (39.28%) demonstrated moderate improvement. Leukonychia was seen in two patients.
Conclusion: The study demonstrates that medium depth combination chemical peels like 15% TCA & 8% Phenol can effectively improve the appearance of superficial nail abnormalities, providing a non-invasive alternative to traditional therapies.

Keywords: Nail plate abnormalities, Combination peel, Phenol, TCA.

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1. Introduction

Nails, while often perceived as a minor detail, contribute significantly to overall aesthetic presentation, fostering a polished and well-groomed appearance. Well-maintained smooth translucent nails can enhance the beauty of hands, complementing personal style and making a positive impression.

People are becoming more conscious about the appearance of their nails. Regular grooming, including manicures & use of various nail chemicals like acetone and others, has led to an increase in rough, dull, and discolored nails. This is also caused by factors like detergent and other chemical exposure.[1]

The term "superficial nail abnormalities" refers to surface-level nail plate changes, such as trachonychia, varied discoloration, ridges, pits etc. It's interesting to note that these may be the only anomaly or they could be a component of the nail symptoms of systemic diseases like hepatic, renal, and cardio-pulmonary disorders, or they could be the hallmark of dermatological diseases like psoriasis, lichen planus, onychomycosis, or twenty-nail dystrophy. Besides above mentioned factors, nutritional deficiencies and age-related

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conditions like onychogryphosis, onycholysis, striations and irregular texture can lead to nail abnormalities.[2,3]

Superficial nail changes that manifest as an isolated finding provide a serious therapeutic problem. Because there is no systemic involvement and the patient is reluctant to undergo systemic therapies, it calls for a conservative management strategy. While intramatricial corticosteroids may offer some benefits, their use is often limited by their invasive nature and the discomfort they can cause during administration.[4,5] Due to the limited therapeutic alternatives available in these circumstances, it is often necessary to investigate cosmetic or camouflage techniques in order to address aesthetic problems.[6]

The idea of using chemicals for skin peeling to enhance beauty is an age-old practice. The principle behind this treatment is the controlled destruction of skin layers, which triggers regeneration and remodelling, ultimately improving skin texture and reducing surface abnormalities. This controlled breakdown of keratin can lead to clinical improvement in superficial nail abnormalities, resulting in more aesthetically pleasing nails. Additionally, it can enhance the transungual delivery of medications by disrupting the disulfide bonds in nail keratin, thereby increasing permeability and hydration.[7,8]

The study by Banga et al. examined the use of 70% glycolic acid peels for dry, rough, and hyperkeratotic nails and reported positive results.[1] The purpose of this study was to evaluate the effectiveness of a medium depth combination chemical peel (15% TCA with 8% Phenol) in improving the appearance of nails with superficial abnormalities.

2. Materials and Methods

We conducted a prospective, uncontrolled, open-label study between Sep 2024 and Jan 2025 after approval from institutional ethics committee (SMC/IEC/64/4/24).

2.1. Inclusion criteria

1. Rough, dull, discolored nails.
2. Thick hyper-keratotic nails due to Lichen planus, Psoriasis, alopecia areata, etc.
3. Nail pitting, nail ridging secondary to aging, nutritional deficiencies or any other factors.

2.2. Exclusion criteria

1. Extremely thin/dystrophic nails.
2. Nail abnormalities with active infection in or around nails.
3. Any visible signs of inflammation in or around nails
4. Known case of hyper-sensitivity to TCA or Phenol.
5. Pregnancy, Lactation & Patients with Unrealistic expectation.

Thirty-one patients fulfilling the inclusion and exclusion criteria were enrolled in the study following the provision of written informed consent. A comprehensive medical history was taken, regarding associated dermatological or systemic disorders, prior cosmetic interventions, and any history of allergic reactions or traumatic/tic-induced deformities. Participants were explained about the procedure, possible side effects like burning sensation, dryness and peeling and expected outcome of improvement in nail texture only and not in their pathological condition. Appropriate measures were taken to exclude the presence of active bacterial or viral infection in and around the nails. When in doubt regarding diagnosis, punch biopsy was done from nail plate and bed only to prevent future dystrophy and scarring.

Prior to peel application, white soft paraffin was applied to the nail folds and cuticles using a cotton-tipped applicator to protect these structures from potential complications (**Figure 1**). The affected nails were then cleaned with an acetone/water solution, and a combined 8% phenol/15% trichloroacetic acid (TCA) peel (pH 0.5) was applied in two coats. The second coat was allowed to remain for 20 minutes before patients were instructed to wash their nails with water. Peel sessions were conducted weekly for four weeks, then every two weeks for the next four sessions. Between sessions, patients were advised to apply bland moisturizers to the nail plates and surrounding areas, and to avoid nail thinners, lacquers, and other nail cosmetics containing urea or lactic acid due to their drying effects.

At the 12-week follow-up, treatment response was assessed objectively using the Nail Surface Abnormality Index (NSI), subjectively by patient perception via the Visual Analogue Scale (VAS), and clinically by the Physician's Global Assessment (PGA).

2.3. Nail Surface abnormality index (NSI)

The nail is assessed by dividing it into four quadrants. Each quadrant is evaluated for four parameters: pitting, discoloration, longitudinal ridging, and horizontal ridging. Each parameter is assigned a score of 1 if present within a quadrant. Therefore, the minimum score for a single nail is 0 (no abnormalities), and the maximum score is 16 (all parameters present in all quadrants).[9]

2.4. Visual analogue scale (VAS)

Each affected nail was assigned a score by the patient, ranging from 0 (indicating a normal nail) to 10 (indicating the most severe abnormality)

2.5. Physician's global assessment (PGA) scores

Clinical assessment and photos were used to determine Physician's Global Assessment (PGA) scores. Response was categorized as Good (>50% improvement), Moderate (25-50%), or Poor (<25%).

All the data were analysed using Microsoft Excel and SPSS software.

3. Results

Of the 31 patients initially enrolled in the study, three patients dropped out after few sessions due to reasons unrelated to the study. So, they were excluded and 28 patients were included in the final analysis. Among the 28 patients analyzed, there were 9 males and 19 females (male: female ratio 1:2.1). Average age was 33.5 years (range 25-47 years). The following clinical diagnoses were represented in the study group: nail psoriasis (n=9), idiopathic trachyonychia (n=8), nail lichen planus (n=7), and alopecia areata (n=4). Seventy-six nails from the 28 participating patients were subjected to the procedure. The number of patients and the nails according to the condition is shown in (**Table 1**). The respective clinical morphological findings are shown in (**Table 2**).

Figure 1: Image showing protection of cuticle and folds by white soft paraffin

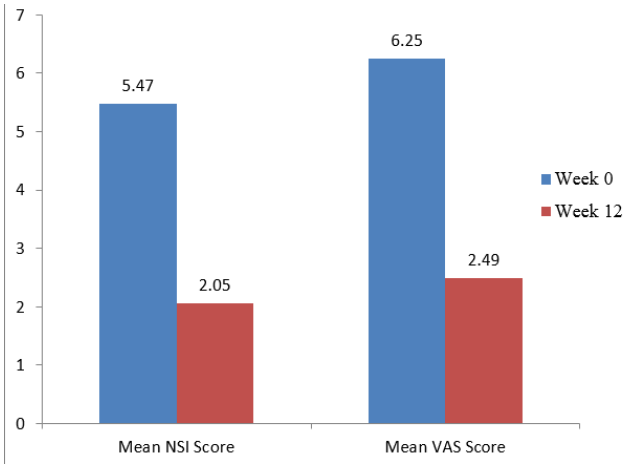

Figure 2: Chart demonstrating reduction in Mean NSI and VAS scores at 12 weeks

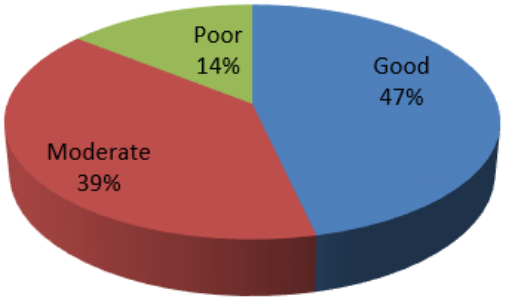

Figure 3: Chart showing PGA score

Figure 4: Sequential image showing improvement in nail plate abnormality

Figure 5: Image showing moderate improvement in nail plate abnormality.

Figure 6: Image showing leukonychia post peel

Table 1: Distribution according to no. of patients and nails

Clinical Diagnosis	No. of patients	No. of nails
Idiopathic Trachyonychia	8	20
Alopecia Areata	4	12
Nail Lichen Planus	7	15
Nail Psoriasis	9	29
Total	28	76

Table 2: Clinical morphological findings

Clinical Morphology	Psoriasis (n=9)	Idiopathic Trachyonychia (n=8)	Alopecia Areata (n=4)	Lichen Planus (n=7)
Subungal Hyperkeratosis	4	-	-	-
Onycholysis	5	-	-	-
Beau's line	1	-	-	2
Coarse Pitting	9	-	-	-
Fine Pitting	-	-	4	-
Yellowish discolouration	1	-	-	3
Crumbling	1	8	-	-
Longitudinal striations	2	8	-	6
Pterygium	-	-	-	2
Koilonychia	-	-	-	-
Blackish discolouration	-	-	-	-
Melanonychia	-	-	-	-

Mean NSI, VAS and PGA scores were assessed at baseline (1st visit); and then serially assessed during subsequent visits. At baseline, the mean NSI score was 5.47. Mean VAS score obtained from patient perception at baseline was 6.25. The study findings showed a progressive decline in the scores. By the end of the 12-week study period, the mean NSI score had dropped from 5.47 to 2.05. Similarly, there was a decrease in the patient-perceived VAS score from 6.25 to 2.49. There was improvement of 62.5% in NSI and 60.2% in VAS scores. A statistically significant improvement ($P < 0.001$) was observed for both scores. (**Figure 2**)

According to the PGA assessment, nine patients (46.43%) showed good improvement, while eleven (39.28%) demonstrated moderate improvement. Four patients (14.29%) showed poor response to the treatment (**Figure 3**). Among the poor responders, two patients were of psoriasis having subungal hyperkeratosis, and one each of trachyonychia and lichen planus. The progressive improvement in nail plate abnormality can be visually seen in **Figure 4**, **Figure 5**.

Most adverse effects were mild and manageable. Four patients experienced mild burning, dryness, and peeling of the skin around the nails. However, almost all the patients tolerated and complied with the peel well enough. Three patients didn't follow the post-peel care thoroughly, of which two developed leukonychia (**Figure 6**). These adverse effects resolved on their own after correction of post-peel care and didn't require discontinuation of the peel.

4. Discussion

Nails possess a subtle yet significant influence on overall aesthetics, contributing to a refined and well-presented appearance. Well-maintained nails, characterized by smoothness and translucency, enhance the aesthetic appeal of the hands, complementing individual style and fostering a favourable impression. A large industry focuses on helping people achieve this. Nail care and decoration are deeply ingrained cultural practices in many parts of the world which dates back to ancient Egyptian and Chinese civilization.[10,11]

Superficial nail abnormalities can have a wide range of psychological impacts, from complete indifference or acceptance to severe self-esteem issues and feelings of depression. As nail grooming practices become more common, superficial nail abnormalities are likely to be noticed more frequently, leading to increased patient seeking treatment. Individuals with these abnormalities may experience heightened distress while using nail cosmetics. Conversely, nail cosmetics usage itself may contribute to the development of superficial nail abnormalities. The excessive application of nail lacquers & nail polish thinners can compromise nail integrity, leading to both weakening and discoloration.[1,11]

The absence of systemic involvement and patient reluctance towards systemic treatments necessitate a conservative management approach. Due to multiple nail involvement, intramatricial injections become cumbersome

and also painful. Chemical Peels remain one of the viable options for this and it has been documented in the past studies.[12] We tried to explore the property of medium depth combination peel (15% TCA & 8% Phenol) to address this issue.

Previous research has established the therapeutic benefit of both 70% and 50% glycolic acid for superficial nail plate abnormalities.[1,3,9,13] There has been paucity of studies using alternative peels than glycolic acid for the purpose.[9] Also assessment in form of subjective scores was used in most of them. We incorporated objective score in form of NSI and subjective scores of VAS and PGA to measure the results of the peel. This study, which mainly focused on cosmetic improvement rather than targeting primary pathology, showed a significant decline in all the scores, viz. NSI, VAS, and PGA.

On cutaneous surfaces, chemical peels exert their action through the removal of the stratum corneum, induction of dermal remodelling, and stimulation of the germinative layer, ultimately resulting in skin rejuvenation.[14] How these peels affect nails depends on the specific nail structure and the chemical properties of the peel. The nail plate is microscopically composed of tightly adherent layers of flat, scale-like cells (onychocytes).[15] The nail matrix is the primary source of the nail plate, with the nail bed playing a minor role. Since different areas of the matrix contribute to specific parts of the nail plate, superficial nail abnormalities such as pitting, ridging, and trachyonychia are likely to arise from the proximal matrix, specifically the area beneath the proximal nail fold.[4]

As nail is thicker as compared to skin and onychocytes tightly adhered, medium depth peels would have to be used to serve the purpose. Phenol, an aromatic alcohol exhibiting weak acidic characteristics, functions as a protoplasmic poison, its mechanism of action involving protein denaturation and enzymatic inactivation. By compromising cell membrane permeability, these processes initiate a cascade of events culminating in cellular death and tissue sloughing.[7,16] Trichloroacetic acid possesses caustic properties, inducing coagulation of skin proteins, resulting in the formation of a frost-like appearance. This coagulative necrosis is followed by an inflammatory response and the activation of wound healing mechanisms, culminating in re-epithelialization. Its self-neutralizing nature prevents systemic absorption.[7]

Upon serial review of clinical photographs, gradual improvement in the form of cleaner and shinier looking nail plate can be appreciated. This could be attributed to the shedding of surface irregularities of the nail plate based on above mentioned mechanism of peel. The changes were most noticeable at the proximal end of the nail and extended distally with nail plate growth. It may be partly attributed to cell signals triggered by protein denaturation and onychocytes shedding and partly due to its influence of proximal matrix through direct diffusion.[9] However the true mechanism is yet to be elicited warranting further investigations.

The majority of adverse effects like burning, dryness and scaling were attributed to the primary mechanism of peel itself and were easily manageable. Leukonychia noticed in patients were due to inability to follow post peel care properly. However, these were self-limiting due to self-neutralizing effect of the peel and cleared subsequently due to peeling effect of the substance. Again further research is needed to fully understand it.

While alternative options like gel, acrylic, and UV-cured nails exist for superficial nail issues, they are often complex, costly, and primarily focus on concealing the problem. In contrast, chemical peels offer a simpler, more affordable and non-invasive approach that goes beyond mere camouflage. However peels don't address the root cause. Repeat treatments may be needed. Future research should address the need for more effective and durable nail formulations.[17]

5. Limitations

Small sample size, short follow up duration, lack of control group.

6. Conclusion

15% TCA with 8% phenol combination peel was found to be an effective medium-depth peel for treating superficial nail abnormalities with minimal side effects. While peels can improve the appearance of superficial nail abnormalities, their effectiveness on deeper irregularities is still uncertain. Additionally, their impact on nail discoloration is unclear, as the source of most nail pigment is deeper within the nail matrix. Although medium-depth peels offer a practical and economical treatment approach, a larger sample size is required to establish definitive efficacy. Future research may explore other types of peels, including combination and sequential approaches.

7. Ethical Committee Approval

Institutional ethics committee approval - SMC/IEC/64/4/24.

8. Abbreviations

Trichloroacetic acid – TCA, Physician’s Global Assessment – PGA, Nail Surface Abnormality Index – NSI, Visual Analogue Scale – VAS

9. Source of Funding

None.

10. Conflict of Interest

None.

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