

Review Article

## Adverse effects of nail cosmetics and how to prevent them

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### ABSTRACT

Nail cosmetics are being used world over for nail enhancement, and their list is an ever expanding one. However, due to their widespread usage, there are an increasing number of adverse effects also being reported. These have been reported both in the users as well as service providers (nail salon workers/technicians). Adverse effects to nail cosmetics usually present to dermatologists, who need to be equipped to suspect, diagnose, and manage them. A whole range of newer nail cosmetic products are available now, which can lead to a variety of adverse reactions. These may be early and hence easy to temporally correlate with cosmetic usage; or have a delayed onset making it difficult to correlate with the nail cosmetic used. Varying presentations include onycholysis, infections, allergic dermatitis, psoriasiform nail changes, and systemic adverse effects. The range of clinical manifestations, prevention, and management of nail cosmetic-related adverse effects are detailed in this review.

**Keywords:** Nail cosmetics, Adverse effects, Nail polish, Acrylates, Gel nails, 2-Hydroxy-ethyl methacrylate

### INTRODUCTION

Nails are considered to be an expression and extension of one's personality. Hence, nail enhancement with nail cosmetics is being done by millions of users the world over, irrespective of their gender and ethnicity. The impact of nail cosmetics is so much that a study assessing self-cosmetic care during the COVID-19 pandemic concluded that female medical students not doing cosmetic care of nails during the lockdown period, perceived a significant negative social impact.<sup>[1]</sup> On the flip side, an increment in the incidence of adverse effects related to nail cosmetics is also being seen due to their increased usage. This is especially common among inexperienced or unaware users.

Even though adverse effects are a reality, nail cosmetics are here to stay, because not only do our patients love them, dermatologists can also use them to advantage in a number of otherwise untreatable nail conditions or as good camouflage options.<sup>[2]</sup> Nail cosmetics have been found useful in patients with nail plate surface abnormalities including onychoschizia, pitting, onychorrhexis, habit tic deformity, onychophagia, and anonychia.<sup>[3,4]</sup> Starace *et al.* demonstrated that the daily application of a cosmetic topical treatment product containing *Pistacia lentiscus* and hyaluronic acid can improve common nail diseases including nail fragility and onychomycosis.<sup>[5]</sup> The ease of application and cosmetic elegance contributed to a greater acceptance by the patients.

Nail cosmetic usage is witnessing an upward trend. Hence, it is important for dermatologists to familiarize themselves with the various nail cosmetics being used by the public and the range

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of adverse effects possible. This review aims to discuss these along with the preventive measures that can be taken to minimize them.

## TYPES OF NAIL COSMETICS

Gone are the days of simple nail polish. Now, we have a range of different types of nail cosmetics available and being used [Table 1]. Their purpose is to enhance the esthetic appeal of the nails and give them a healthy and nourished appearance, which is considered indicative of the social status of a person as well [Figure 1a and b]. These are also being used for diseased nails, as camouflage for the distorted appearance, enhancement of cosmetic appeal, ensuring a smooth, shiny appearance, lengthening them by artificial extension, or strengthening them (like gel nails being used for brittle nails). The adverse effects may be due to individual predisposition or incorrect usage. The commonly used nail cosmetics with adverse effects associated with them are discussed below.

## Nail polish

The most common use of nail polish is for the beautification of nails. However, it is also used for strengthening brittle nails and camouflaging discolored and irregular nails. Nail polish is actually a mixture of an assortment of various components as shown in Table 2. Adverse effects related to nail polish can be many. It can lead to nail damage due to its ingredients, the way it has been used, or more importantly, the way it has been removed. Salient nail polish related adverse effects include:

### *Discoloration of the nail plate*

- On repeated usage, various colorants, especially the red or yellow color of the nail polish, tend to stain the nail plate. It is a consequence of harmless keratin staining. This pattern of staining can be reproduced solely with the pigments D and C red no 7, D and C red no 34, D and C red no 6, and FD and C yellow no 5 lake.<sup>[6]</sup>

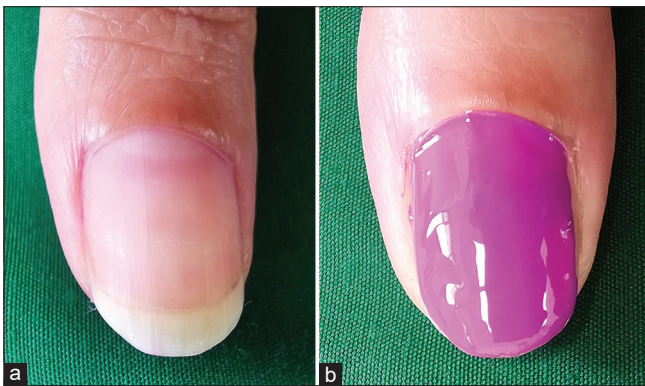
**Table 1:** Range of nail cosmetics and nail toiletries in vogue.

Nail polish	<ul style="list-style-type: none"> <li>• Base coat- Fills irregularities and gives uniform natural color.</li> <li>• Top coat- Adds gloss and prevents premature chipping.</li> </ul> <p>The constituents of nail polish include</p> <ul style="list-style-type: none"> <li>• 70% solvent- extender (toluene, butyl or ethyl acetate and isopropyl alcohol) to keep the polish liquid.</li> <li>• 0–1% pigment</li> <li>• 1% suspending agent</li> </ul>
Nail polish variants	<ul style="list-style-type: none"> <li>• Nail polish finishers</li> <li>• Photochromic nail polish</li> <li>• Thermochromic nail polish</li> <li>• Caviar nail polish</li> <li>• Magnetic nail polish</li> <li>• Crackle nail polish</li> <li>• Breathable nail polish</li> <li>• Nail stickers and strips</li> <li>• Hypoallergenic nail polish</li> </ul>
Nail polish removers	<ul style="list-style-type: none"> <li>• Acetone free removers</li> <li>• Nail polish removal pads</li> <li>• Nail polish removers with fatty materials, lanolin, castor oil, acetyl palmitate and other synthetic oils.</li> </ul>
Nail shellacs	<ul style="list-style-type: none"> <li>• Use polymerization photo-initiators and acrylate oligo or monomers along with pigment from nail lacquers</li> <li>• Six coating steps, each followed by exposure to light emitting diodes.</li> </ul>
Artificial nails	<ul style="list-style-type: none"> <li>• Preformed artificial nails</li> <li>• Nail tips</li> <li>• Nail wraps and modifications</li> <li>• Sculptured nails- Acrylic and gel nails</li> </ul>
Nail adornments	<ul style="list-style-type: none"> <li>• Nail stickers</li> <li>• Color strips</li> <li>• Nail Jewels</li> <li>• Metal artifacts</li> </ul>
Nail moisturizers	<ul style="list-style-type: none"> <li>• Petrolatum</li> <li>• Lanolin</li> <li>• Humectants</li> <li>• Urea</li> <li>• Alpha -hydroxy acids.</li> </ul>

**Table 2:** Key constituents/ingredients of nail polish.

Basic constituents of nail polish	Components	Role in nail polish
Film forming agents	Nitrocellulose, methacrylate polymers, and vinyl polymers	Lead to adherence and prevention of chipping of nail paint TSFR is a potent cause of contact allergic dermatitis
Film forming resins	Formaldehyde, TSFR	
Plasticizers	Diethylphthalate, dibutyl phthalate, dioctyl- phthalate, tricresyl phosphate and camphor	Prevention of chipping
Solvents and diluents		Maintain pliability of the product Responsible for quick drying of nail paint Leave colored film behind
Colorants	Various organic and inorganic pigments	Uniform suspension of ingredients Prevent UV-induced color fading
Thickening agents	Clay derivatives	
Color stabilizers	Benzophenone and Etocrylene	
	Mineral pigments: Zinc oxide, Titanium oxide, Iron oxide Synthetic pigments: D and C red 6/7/19, FDC Yellow	

TSFR: Toluene sulfonamide formaldehyde resin, UV: Ultraviolet



**Figure 1:** (a and b) Appearance of the nail plate, when enhanced with cosmetics. This is perceived to indicate societal status and well-being.

The likelihood of residual staining increases with nail polishes in which the pigments are dissolved and not suspended. If the nail polish is left on for longer periods, especially more than seven days, the discoloration starts developing. Upon removal of nail polish, the discoloration tends to self resolve over two weeks. Such discoloration of the nail plate can often be prevented by using a basecoat.<sup>[7]</sup> However, the base coat may not always provide protection.

### ***Keratin degranulation***

It is a type of pseudo-leukonychia, which can result from nail polish binding and subsequently being removed from the nail plate.<sup>[8]</sup> The nail polish interacts with keratin leading to the appearance of white striae [Figure 2].



**Figure 2:** Pseudoleukonychia or keratin degranulation seen after prolonged nail polish application and removal.

Clinical presentation can also be in the form of macules or patches on the nail plate. Onychoscopy shows white areas corresponding to the areas of nail plate exfoliation.<sup>[9]</sup> The condition can be clinically misdiagnosed as superficial white onychomycosis.<sup>[9]</sup> Management includes gentle nail care and avoiding frequent contact with irritant and allergenic grooming products including nail polish and remover.<sup>[10]</sup>

### ***Allergic contact dermatitis***

- This should be suspected in a patient presenting with itching and/or scaling in the periungual region [Figure 3]. However, manifestations may not be limited to the nail

unit, but can also occur in distant regions, wherever the nail tends to touch and transfer the allergen. The secondary film formers in nail polish are usually resins, especially Toluene Sulphonamide Formaldehyde Resin (TSFR) [Table 2]. TSFR has traditionally been recognized as the causative factor responsible for most cases of allergic contact dermatitis, including facial dermatitis in women.<sup>[11]</sup> The other common allergens include formaldehyde, nitrocellulose,<sup>[12]</sup> dibutyl phthalate,<sup>[13]</sup> and D and C yellow 11.<sup>[14]</sup> Various components of nail polish responsible for contact allergic dermatitis and its manifestations are shown in Table 3.



**Figure 3:** Contact allergic dermatitis involving the periungual area, due to nail polish (ROAT or Repeat Open application Test done). Chronic paronychia with greenish discoloration (chloronychia) can also be seen.

As the most common allergen in nail polish is TSFR, a variety of “toxin-free nail polishes,” free of it, are available. These are promoted as hypoallergenic and contain cellulose, acetate, butyrate, and polyester resins. However, they may contain plasticizers such as dibutyl phthalate for softness and pliability, dissolved in solvents (N-butyl acetate or ethyl acetate). Nail polishes free of toluene, phthalate, and formaldehyde are also available. These contain natural pigments in a water base. An important ingredient of these nail polishes is argan oil. Nevertheless, there are reports of allergic reactions to these “hypoallergenic nail polishes” as well, since most brands can have at least one component that can trigger allergic reactions in individuals. Hence, it is suggested that before their usage, a patch test with specific allergens based on the exact composition of these products may be considered.<sup>[15]</sup>

### Heavy metal-associated adverse effects

Nail plate fragility and cracks can occur due to chronic and slow exposure to low levels of lead and arsenic in nail polish.<sup>[16]</sup> As of now lead and arsenic usage in cosmetics is restricted as they can cause long-term systemic disease as well. Nickel in nail polish can cause contact allergy, with nail and skin problems.<sup>[17]</sup> Kim *et al.* studied the presence of heavy metals in nail cosmetics and concluded that their content was lower than the permissible limit; hence, nail cosmetics may not pose a lifetime cancer risk.<sup>[18]</sup> However, with continued usage over a long period, the risk still needs to be kept in mind.

### Nail polish removers

The process of nail polish removal involves the dissolution of the resin deposited on the nail plate surface. The remover is applied over the painted nail with the help of a cotton or tissue and removed or a cotton ball with remover is wrapped in an

**Table 3:** Common sensitizers present in nail cosmetics.

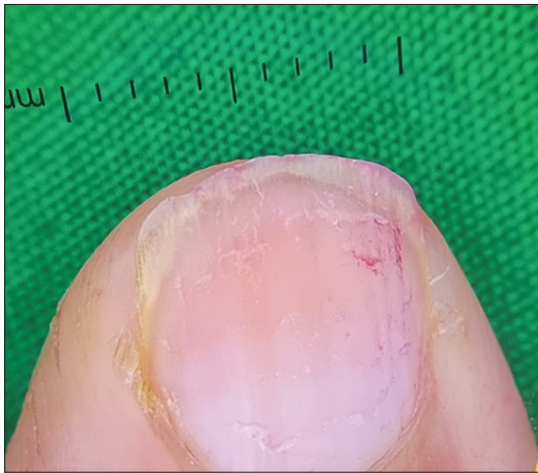
Adverse effect	Nail cosmetic implicated	Causative allergen/agent
Contact dermatitis	Nail polish	Nitrocellulose, formaldehyde, TSFR, dibutyl phthalate, butyl stearate, D and C yellow 11, nickel-based solvents
	Nail adhesives	Methacrylate, ethyl-2-cyanoacrylate
	Acrylic nails	Methacrylate, hydroxyethyl methacrylate, benzoyl peroxide
	Gel nails	2-HEMA and 2-HPMA
	Nail hardeners	Formaldehyde
Onycholysis	Nail polish	TSFR
	Acrylic nails	Methyl acrylate or cyanoacrylate nail glue
	Gel nails	Photo-onycholysis (If patient is taking tetracyclines or doxycycline)
	Nail hardeners	Formaldehyde
Paronychia	Nail polish	Formaldehyde
	Cuticle remover	Sodium and potassium hydroxide
	Gel nails	Cyanoacrylate glue

TSFR: Toluene sulfonamide formaldehyde resin, 2-HEMA: 2-hydroxyethyl methacrylate, 2-HPMA: 2-hydroxypropyl methacrylate

aluminium foil around the digital tip. Nail polish removers are also available in a variety of options. The common ones and their associated adverse effects are described below. To minimize these adverse effects, the products should be used sparingly and infrequently.

#### **Acetone-based nail polish removers**

Acetone is one of the commonly used organic solvents in most of the commonly available nail polish removers.<sup>[7]</sup> It is an irritant even at lower concentrations and leads to dry, lustreless nails.<sup>[7]</sup> In mild cases, it can also lead to onychoschizia or lamellar splitting of the nail plate [Figure 4]. In more severe cases, irritant dermatitis of the perionychial tissue is possible, especially if kept in contact for a longer period [Figure 5].



**Figure 4:** Lamellar splitting of the distal end of the nail plate (onychoschizia) noticed after nail polish removal (DermLite DL4 Polarized  $\times 10$ ).



**Figure 5:** Dry, lustreless, brittle nails due to repeated use of acetone-based nail polish remover.

#### **Acetone free nail polish removers**

These contain ethyl acetate, butyl acetate or ethyl lactate. They have less odor and are relatively less drying in comparison to acetone. They are considered safe for human use.

#### **Nail polish remover pads**

These contain gamma-butyrolactone, considered safe and convenient to use. Rarely, there have been instances of conversion to gamma-hydroxybutyrate leading to systemic toxicity.<sup>[8]</sup>

#### **Nail shellac**

This product is a hybrid of nail polish and gel.<sup>[19,20]</sup> It resists chipping and can be worn over a normal nail plate. The shellacs, in comparison to gel nails, are less heavy and thinner. They can be easily removed with acetone. However, fracture of the nail plate can occur while removing nail shellac.

#### **Nail hardeners**

Nail hardeners are a set of products promoted as useful for soft, brittle, and thin nails, prone to splitting.<sup>[21]</sup> They are considered modifications of nail polish with a different solvent and resin concentration. In addition, they also contain keratin, vitamins, calcium fluoride, natural oils, nylon fibers, Teflon, and silk. The base coat of nail hardeners moves through the porous structure of the nail plate to provide it strength and flexibility. Their application also reduces trans-onychial water loss.

Although the purpose of nail hardeners is to strengthen the nail plate, their prolonged use can paradoxically lead to brittle nails, as the cross-link density within the nail plate increases and its flexibility is reduced. They should be periodically removed with nail polish removers. Other attributable adverse effects include contact allergic dermatitis, onycholysis, and subungual hyperkeratosis.<sup>[22]</sup>

#### **Artificial nails**

Long nails have always been considered a desirable and distinct sign of beauty, throughout human history. This can be achieved with the help of false nails or extensions placed to simulate a true nail. With advancements in this field, various techniques and products have been found useful to produce longer and stronger nails [Table 1]. However, their use is associated with mechanical and chemical adverse effects. Various types of artificial nails and their associated adverse effects are summarized below.

1. Nail tips are preformed tips that can be placed over a pre-existing nail and trimmed to the desired shape. Adverse effects associated with their usage include onychoschizia

or lamellar splitting of the nail, due to the mechanical tug on the nail plate and traumatic removal [Figure 6]. Due to the fact that nail tips are inflexible, they can lead to onycholysis as well. Cyanoacrylate glues, used as adhesive agents to fix the nail tips to the nail plate surface, can rarely lead to contact allergic dermatitis.

2. Nail wrap refers to the technique of applying linen, fiberglass or silk over the surface of a natural nail plate. This is done using glue, followed by the application of an acrylic coat. They have been used as a remedy for split nail deformity as well. Not many adverse effects have been reported.
3. Sculptured nails are nail substitutes applied over existing nail plates. These can be custom designed as per the size and shape of the nail on which they are to be worn. They can be either acrylic or gel based. Both these types involve a mixture of powder and a solution applied over the nail. It is important to have an understanding of the various materials used in the preparation/application of these nails, to have an insight into the adverse effects associated with them.
  - Acrylic nails are less popular currently due to various reasons including their less than natural appearance.<sup>[7]</sup> The application involves strong chemicals and fumes, which are not advisable in pregnancy. The process of application of acrylic nails involves the preparation of a polymerized acrylic by mixing liquid ethyl or isobutyl methacrylate with powdered polymethyl-methacrylate polymer.<sup>[8]</sup> A benzoyl peroxide accelerator is used to enhance polymerization. Sometimes, hydroquinone is used to slow down polymerization. The product hardens in 7–9 min and, therefore, needs to be applied



**Figure 6:** Traumatic nail dystrophy due to removal of nail tips.

quickly onto a chemically roughened nail plate. This application is done to the desired length and shape. A variation of this process involves preformed tips at the distal ends of the nail, making it quicker and less expensive to use. They do not require photocuring.

There are various adverse effects associated. Acrylates have been identified as potent allergens, necessitating the implementation of safety measures for the use of these chemicals in various nail techniques.<sup>[23]</sup> Over the past few years, there have been an increasing number of reports on allergic contact dermatitis due to acrylates. Among these, 2-Hydroxy-Ethyl Methacrylate (HEMA) is considered to be the main culprit.<sup>[24]</sup> HEMA was by far the most common ingredient of nail cosmetics, being present in nearly 60% of the products.

Worn-down nails (over-filed nails) are also an adverse effect seen as a direct consequence of procedure-induced trauma. It is seen typically with acrylic nail removal, where mechanical abrasion is required. The overfiled section of the nail is clinically visible as red in color due to nail plate thinning and the visibility of the nail bed underneath. Linear striations due to back-and-forth filing of nails may also be evident clinically, though better visualized onychoscopically. Dilated capillaries and pinpoint hemorrhages are the other onychoscopic features.

- Gel nails - These are a commonly used cosmetic procedure, used to improve the appearance even in disease-induced nail disfigurement.<sup>[25]</sup> They have been used in various indications such as trachyonychia, superficial nail pitting, onychorrhexis, onychoschizia, idiopathic Beau's lines, and longitudinal ridging with rewarding results.<sup>[3]</sup>

Gel nails can lead to allergic contact dermatitis due to acrylates present in the preparation. Freeman *et al.* reported four cases of contact allergy to acrylates with varied reactions, including nail fold, fingertip, and hand dermatitis and face and neck dermatitis.<sup>[26]</sup> In a case series, all patients were found positive on patch testing for HEMA and experienced resolution of dermatitis after removal of their acrylic nails or upon discontinuing work with acrylic gel nails.<sup>[27]</sup> Less frequent complications including paronychia, nail dystrophy, and onycholysis have also been reported.<sup>[27]</sup> Patients with known acrylate allergy should disclose this information to other medical personnel including dentists and orthopedic surgeons, to avoid potential adverse reactions to procedures other than nail procedures.

Psoriasisform onychodystrophy has been reported to be induced by photo-bonded nails.<sup>[28,29]</sup> The patients characteristically present with nail changes suggestive of psoriasis, including onycholysis, splinter hemorrhages, hyperkeratosis, and nail plate thinning [Figure 7]. However, these occur as a consequence of gel manicures. Over a period of time, as nails grow, the gel nails require in-fillings

[Figure 8]. Since gel manicures and pedicures are on the rise, these changes are also more commonly reported, necessitating the formulation of recommendations to avoid these complications.

Peripheral neuropathy is a relatively rare complication reported with the use of gel nails.<sup>[30]</sup> It may be associated with local neuropathy induced by methyl-methacrylate.<sup>[30]</sup> The use of ultraviolet light has been linked both with cutaneous



**Figure 7:** Pseudo-psoriatic nail as seen on onychoscopy. The patient was not a known case of psoriasis. The onset of nail changes was seen after the usage of artificial nails (Dermlite DL4 Polarized  $\times 10$ ).



**Figure 8:** Synthetic nail requiring in-fills at the proximal end.

**Table 4:** Important points to be kept in mind to minimize adverse effects with gel nails.

- Align the patient properly regarding expected outcomes and possible adverse effects
- History of allergic reaction to nail cosmetics/artificial nails should be elicited
- The cuticle should not be manipulated at all
- Buffing, though an important step, should be kept to minimum
- Gel should not be applied on the cuticle or surrounding skin to reduce chances of allergic reaction
- When curing the nails with UV light, cover the rest of the hand
- Apply broad-spectrum sunscreen 20 min before curing with a lamp
- Patients can be advised to wear nitrile gloves with fingertips cut off<sup>[31]</sup>
- Proper equipment care-cleaning/changing bulbs
- For removal of gel nail, Nanda *et al.* suggested the use of cotton ball dipped in nail polish remover for 10 min reducing chances of allergy or dehydration of surrounding skin<sup>[3]</sup>

UV: Ultraviolet

malignancy and ocular toxicity. The use of ultraviolet A (UVA) lamps in curing gel nails is the step considered responsible for this. Diffey concluded that although the risk of inducing squamous cell carcinoma from exposure to UVA nail lamps is very low, it should be reduced further by wearing fingerless gloves on lamp exposure.<sup>[31]</sup> The scatter of light from the UV light unit onto the eyes has also raised concern regarding ocular toxicity. It may be prudent to use UV filter glasses to protect the eyes. Various important points to be kept in mind while performing gel nails to minimize the adverse effects associated with them are shown in Table 4.

## HEMA AND NAIL COSMETICS

HEMA is the most frequently reacting acrylate and is now considered to be an important cause of contact allergic dermatitis.<sup>[32]</sup> It is present in dental materials, glues, and printing inks and paints, apart from nail cosmetics. Previously, sensitized patients were more prone to the development of contact allergic dermatitis, including dental personnel, printers, and industry workers in contact with the glue.

HEMA has emerged consistently as the most sensitizing monomer, with HEMA allergic reactions affecting health professionals and users both. The majority of cases of contact allergic dermatitis to HEMA are related to cosmetic nail products including acrylic nails, gel nails, and long-lasting nail polish (gel lacquer) [Figure 9]. These are seen both in nail technicians (considered to be an occupational dermatosis) and in clients/women doing self-applications at home. This has necessitated stringent policies regarding the use of these chemicals in aesthetic procedures.<sup>[33]</sup> Due to a large number of patients reporting contact allergy to HEMA in nail cosmetics, the European Union restricted the use of HEMA in nail cosmetics in 2020, permitting it



**Figure 9:** Finger-tip dermatitis in a nail salon worker.

only for professional use. This meant that warnings like “For professional use only” and “Can cause an allergic reaction” were mandated on the package of nail products containing HEMA.<sup>[32]</sup>

### NAIL COSMETICS AND HEALTHCARE WORKERS

It is well documented that chipped-off nail enamel and long artificial nails can harbor various organisms including

*Klebsiella*, *Pseudomonas*, and *Candida*. These can get transmitted to patients since they are difficult to be washed with soap. Hence, the old chipped-off nail polish should be removed, and nails should be kept short by healthcare workers.<sup>[34]</sup>

### NAIL COSMETICS AND NAIL TECHNICIANS

Nail technicians are exposed to a variety of occupational hazards at the workplace, due to their job profile. Thus, they form an important subset of patients presenting with adverse effects to nail cosmetics. Occupational hazards include those due to bad ergonomics as a large part of their time at work is spent in a bent position. In addition, there are safety hazards related to chemical, physical, and biological factors.

- Ergonomics-wise, a nail salon worker or nail technician’s job entails sitting for prolonged periods, while bending and adopting awkward uncomfortable postures. They report more musculoskeletal injuries due to prolonged sitting and bending.<sup>[35]</sup> Neck, back, and hand/wrist pain are common symptoms in nail technicians.
- Chemical exposure in nail technicians including exposure to formaldehyde, toluene, phthalates, and acrylates is a significant occupational hazard.<sup>[36,37]</sup> Respiratory diseases can occur from working in nail salons.<sup>[38]</sup>

**Table 5:** Uncommon adverse effects of nail cosmetics.

Adverse effect	Responsible nail cosmetic	Responsible component
Desquamative gingivitis	Nail polish	Tosylamide/formaldehyde resin
Decreased sperm mobility and viability	Nail polish	Dibutyl Phthalate
Withdrawal symptoms and acute renal failure when used as an addiction drug	Nail polish remover	Gamma butyrolactone
Acute toxicity in infants	Nail polish remover	Gamma butyrolactone
Paresthesia	Sculptured acrylic nail	Acrylates
Respiratory complaints (Occupational) <sup>[41]</sup>	Acrylic nail development	Acrylic resins
Effect on pulse oximeter readings <sup>[41]</sup>	Nail polish	Fingernails painted with black or brown nail paint showed a 2% decrease in the measurement of oxygen saturation
Neurological symptoms - Mild cognitive and neurosensory symptoms (Occupational)	Nail cosmetic development	Solvents and methacrylates
Transmission of infections (Occupational)	Artificial nails and adornments	Artificial nails harbor bacteria that are difficult to remove by cleansing with antimicrobial soaps or alcohol-based gels. This can be hazardous In hospital settings.
Pterygium inversum unguis <sup>[42]</sup> [Figure 10a and b]	Gel nails	Nail fortifiers containing formaldehyde and acrylic nails and UV/LED gel polishes can be causative agents.

UV: Ultraviolet, LED: Light-emitting diode



**Table 6:** Management of adverse effects of nail cosmetics.

Adverse effect	Cause	Management
Onychoschizia Keratin staining/ Keratin granulation/ Pseudo-leukonychia	Repeated and/or prolonged nail polish application	Do not leave nail polish for more than two weeks
Paronychia, infections (bacterial, fungal, viral) Nail staining	Non-sterile instruments  Nail pigment is dissolved rather than suspended	Use sterile instruments and if possible, disposable ones.  Avoid repeated use of nail polish, avoid deep colors, especially red
Nail plate fracture	Occurs with shellac nail gel during removal	There are reduction in chances of nail plate damage
Onycholysis	Seen with gel nails, due to a strong bond formed between etched nail plate and acrylic	Avoid deep etching of nail plate, both physical and chemical
Discolored yellow thin nail	Seen after nail sculpturing with shellac gel nail The natural nail plate gets damaged after 2–4 months of wear	Avoid wearing sculptured nails for more than three months Ensure a gap of one month in between application of subsequent gel nails
Allergic contact dermatitis	Various allergens as discussed in text	Use of hypoallergenic products Avoidance in cases with known hypersensitivity
Burns Nail matrix damage	Methacrylate's if spilled Improper technique of artificial nail application with liquid acrylic entering underneath the proximal nail fold	Careful handling Adequate training of staff
UV light related concerns	UV exposure in curing lamps	Wearing of nitrile gloves, sunscreens

UV: Ultraviolet



**Figure 10:** (a and b) Pterygium inversum unguis due to gel nails. The patient had no other skin lesions, tightening of skin, or any other predisposing factors.

- Handling of sharp instruments may also result in pricks and punctures.
- Infection is a common complication of nail cosmetics. The workers are also exposed to a variety of pathogens including fungi and bacteria from unsterile instruments and cuts and pricks from sharp instruments used in the performance of cosmetic nail procedures.<sup>[39]</sup>

Prevention of health hazards among nail salon workers requires efforts to increase knowledge and improve occupational health in nail salons.<sup>[35]</sup> Dissemination of education regarding workplace hazards and their impact reduction can go a long way in preventing such outcomes. Improved ergonomics can lead to an immediate improvement in their condition, going a long way in minimizing morbidity. It is important to focus on educating nail salon workers regarding the health hazards of chemical exposure, providing them with the right kind of gloves and ensuring good ventilation at the workplace. The nail technicians should also wear proper well-fitting masks and protective eyewear. At the worksite, there is inevitable contact with nail materials daily. It should be ensured that the tools and work surfaces are free from allergens. Extreme precautions should be taken while performing work to ensure that acrylates do not spread on skin or surrounding surface or equipment, as these can subsequently act as a source of exposure. Suuronen *et al.* performed a simplified penetration test to evaluate the suitability of disposable glove material to be used in nail salons for protection against methacrylates.<sup>[40]</sup> They

concluded that neoprene was the best material for protection against gel nail products. Other materials were not found suitable for protection against acrylates which could penetrate through or even degrade the glove material very quickly. Disposable gloves should not be used for handling of acrylic nail liquids. Some uncommon adverse effects of nail cosmetics are shown in Table 5.

## MANAGEMENT

Adverse events may occur during the nail grooming procedure or as an adverse reaction to individual components of nail cosmetics. It is important to have an understanding of the adverse effects and their management. These include acute toxicity, paresthesiae and neurological complaints, respiratory complaints, and pterygium inversum [Figure 10].<sup>[41,42]</sup> The management approach is shown in Table 6.

## CONCLUSION

The field of nail aesthetics is fast expanding and improvising to meet the increasing demand of consumers worldwide. Nail cosmetics are considered to be relatively safe; however, they can lead to significant contact allergic or irritant dermatitis, infections, and nail damage. Therefore, awareness regarding their clinical presentations, techniques and materials used in the nail cosmetic industry, and viable management options, is absolutely essential for dermatologists to educate and promote safe nail cosmetics in patients and manage complications.

### Ethical approval

The Institutional Review Board approval is not required.

### Declaration of patient consent

Patient's consent not required as there are no patients in this study.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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