Contact Dermatitis in Nail Cosmetics

Subjects: Allergy

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Many ingredients found within nail cosmetic products are capable of sensitizing patients' immune systems and causing contact dermatitis (CD). Below this entry describes the most common allergens found within these products, how to identify them, and how to treat the contact dermatitis they've caused.

common nail cosmetic products | Nail cosmetics | contact dermatitis

1. Common Nail Cosmetic Products and Associated Allergens

According to modern beauty standards, aesthetically pleasing nails have a glossy, smooth surface, no overhanging or ragged cuticles, a tip extending beyond the nail plate, an oval contour to the nail plate, and a gentle curve when visualized from the side [1]. A variety of products can be used to achieve these looks, including liquid nail polish, nail wraps, gel nail polish, dipping powders, and acrylics (often referred to as "tips") [2]. Other nail care products include nail strengthener, cuticle softener, and nail hydrating polishes, oils, and serums. More detailed descriptions of these products can be found in **Table 1**. Regular manicures using nail polish and gel manicures are the two most popular nail cosmetic procedures in the USA [3].

Table 1. Description of common nail cosmetic products.

Product (Synonyms)	Purpose	Application Process	Approximate Duration
Nail Polish (lacquer, varnish)	Gives nails color and shine	Painted directly onto nail plate or on top of acrylic or gel nails, with or without base or top coats. Can be applied at home or in salons	<1 week
Base Coat	Creates an even surface for the color coat and facilitates adhesion	Applied directly to nail plate prior to application of colored nail polish	N/A
Top Coat	Gives a glossy finish and protects nail enamel	Applied on top of colored nail polish	N/A
Nail Polish Remover (acetone)	Dissolves and removes nail polish and gel polish	Nail polish: wiped onto nails using a cotton applicator (such as a cotton ball or swab) Gel polish: poured into a bowl in which nails	N/A

Product (Synonyms)	Purpose	Application Process	Approximate Duration
		are soaked for several min or tightly applied to the nails using a cotton applicator and aluminum foil for several min	
Nail Wraps (silk nails, preformed nails)	Reinforce weak, brittle, or breaking nails	Sheets applied directly to nail plate with cyanoacrylate-based nail glue or adhesive backing, then warmed and trimmed to accommodate the shape of the underlying nail	1–2 weeks
Press-on Nails (fake nails, stick-ons)	Immediate color/design with durable shine and shape Quick application that requires little to no skill	Plastic nail applied directly to nail plate with cyanoacrylate-based glue or adhesive backing	1–2 weeks
Gel Nail Polish (long-lasting, semipermanent)	Long-lasting color Less drying time compared to liquid nail polish	Liquid polish made of acrylic monomers is painted directly onto the nail plate or on top of acrylic nails. Each applied layer (3+) is cured with a UV or LED light (30 s–2 min) to allow for polymerization of acrylic monomers	2+ weeks
Powder Nails (dipped nails, dipping powders)	Long-lasting color with a hard, durable finish Appeals to many concerned about UV exposure with gel polish	Nail prepared with cyanoacrylate-based nail glue is dipped into polymer powder. A water-based activator is then applied to the nails, hardening the polish	2–4 weeks
Acrylic Nails (tips, nail extensions, porcelain nails)	Adds length and shape to existing nail	Powder polymers mixed with liquid acrylic monomers and then sculpted onto the nail plate	2–3 weeks

nts within a recent cosmetic ingredients most frequently revealed positive reactions in response to hydroxyethyl methacrylate (56.6%), tosylamide (36.2%), methylmethacrylate (27.8%), ethyl acrylate (25.2%), and ethyl-2-cyanoacrylate (6.9%) [4]. We discuss these and other common ingredients below:

- **Tosylamide/formaldehyde resin (TSFR)** has long been known to be the most common cause of ACD related to nail polish, with data from the North American Contact Dermatitis Group (NACDG) suggesting that 4% of all positive patch tests involved sensitivity to TSFR [5]. It has been found to sensitize both nail components as well as produce ectopic ACD in areas of touching, scratching, or rubbing [6]. Because of this, many nail polish brands have switched formulation to include **tosylamide epoxy** resin instead; however, this has also been shown to sensitize both locally and ectopically [7].

- **Methacrylates** (powder and liquid) are mixed to form a flexible polymer for acrylic manicures. These ingredients can also be found in smaller quantities in both regular and gel nail polish. The three most common

allergenic forms of these ingredients are 2-hydroxyethyl methacrylate (2-HEMA), 2-hydroxypropyl methacrylate (2-HPMA), and ethylene glycol dimethacrylate (EGDMA) [8][9]. These ingredients are most sensitizing in their liquid form (during application) and rarely cause reactions once hardened and cured. In addition, methacrylates are extremely cross-reactive with one another, so people are often allergic to multiple [7].

- **Acrylates** are mainly used in gel manicure systems. These include 2-hydroxyethyl acrylate (2-HEA), 2-ethylhexyl acrylate (2-EHA), 2-hydroxypropyl acrylate (2-HPA), ethyl acrylate (EA), and triethylene glycol diacrylate (TREGDA) [10]. With the increasing popularity of and consumer access to "at-home" gel manicure kits, sensitization to acrylates has increased, and those that use such kits are also more likely to be sensitized [11][12].

- **Dibutyl phthalate (DBP)** is considered a "plasticizer" that increases nail polish flexibility [13]. It has not only been seen to cause ACD, but it has also been shown to interfere with male reproductive development in animal models [14].

- **Benzophenone** is an additive to regular and gel nail polishes that protects cosmetic products by absorbing UV light and preventing product degradation prior to use. Cases report both ACD and photocontact dermatitis as a result of contact with benzophenone [15].

- **Formaldehyde** (also listed as **formalin** or **methylene glycol**) is the main ingredient in nail strengthening products and has been shown to cause ACD [6].

- Solvents such as **ethyl acetate** and **isopropyl alcohol** have been shown to cause ICD and ACD, albeit rarely. However, more recent studies have led many to believe that reactions to isopropyl alcohol are more common than once thought [16]. These ingredients can be found in both nail polishes as well as nail dehydrators.

- **Ethyl Cyanoacrylate (ECA)** is an ingredient in nail glue that has been associated with ACD, paronychia, and nail dystrophy [17][18]. While similar in name to (meth)acrylates (see below), evidence shows that there is no cross-sensitization between the two ingredients.

- **Methacrylic Acid (MAA)** is an ingredient in acidic nail primer that is known to be an extremely corrosive chemical. It can cause ACD if it accidentally comes in contact with the skin or cuticle on application [19]. Non-acid primers, those that do not contain MAA, have become more popular in order to avoid this adverse reaction; however, these still contain other allergens and irritants.

2. Treatment

2.1. Behavioral Interventions

Causative substance identification, removal, and avoidance is a mainstay of treatment for CD of any etiology. Ingredients that are more specific to certain products and/or nail procedures are likely easier to eliminate and, if

desired, substitute. However, caution must still be taken. Patients must be aware that most polishes labeled “hypoallergenic” do not contain TSFR; however, these polishes typically still contain (meth)acrylates [20]. Additionally, some allergic to (meth)acrylates may find regular nail polish (that contains (meth)acrylates in much lower concentrations) to be a suitable substitution, while others continue to react. Some brands, such as CND Shellac and BRISA, claim to have created “acrylate-free” gel polishes, which have anecdotally been nonreactive in some with proven acrylate allergies. However, since cosmetics do not have ingredient regulating bodies, anyone with a history of CD secondary to nail cosmetic use should try new products with extreme caution [8].

For nail technicians and beauticians who occupationally come in contact with these allergens, latex gloves should be avoided as (meth)acrylates have been shown to penetrate through this material [21]. Rather, nitrile gloves should be used and switched every hour, as after this time frame, protection can diminish. Trilaminated polyethylene gloves are the most effective at protecting underlying skin from (meth)acrylates and other ingredients, but these are typically impractical [22].

2.2. Topical Anti-Inflammatory Treatment

For immediate treatment of CD skin lesions, topical steroids can be prescribed. Caution should be taken to prescribe a steroid of appropriate potency for the affected region, such as higher potency steroids for hand lesions and lower potency steroids for the more delicate the face [23]. Ointments may be chosen over creams as they are less likely to contain allergenic preservatives [24]. Alternatively, topical calcineurin inhibitors, such as pimecrolimus, tacrolimus, and cyclosporine, can be useful for ACD of the eyelids [25].

2.3. Emollients and Barrier Creams

Emollients and barrier creams, such as petrolatum, dimethicone, and paraffin, should be recommended in both treatment and prevention of CD by providing an extra layer of protection from allergens above the stratum corneum [26]. These creams have also been shown to have some anti-inflammatory properties as well as the ability to restore the skin barrier [23]. Hyaluronic acids can enhance intracellular lipid production, while ceramides help to retain moisture [27]. Occlusive dressings with emollients placed over affected areas (when practical) may help emollient adherence to skin and decrease subsequent exposure to allergens prior to healing.

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