

Trends in Nail Services May Cause Dermatitis: Not Your Mother's Nail Polish

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PRACTICE POINTS

- Changing trends in nail services mean new exposures for consumers. Traditional nail polish has been replaced by semipermanent nail polish, which contains acrylates.
- Acrylates are a common cause of allergic contact dermatitis from nail polish. Acrylates can be found in gel, dip, and shellac nail polishes, among others.
- Patch testing with 2-hydroxyethyl methacrylate and ethyl cyanoacrylate can screen many patients for allergy due to nail services.

The advent of acrylate-based nail treatments—known as gels, dips, or shellac—has resulted in an uptick in nail-related acrylate allergy. Acrylate dermatitis related to nail services can affect both clients and technicians and can present on the hands, fingers, and wrists, as well as on the face and neck. Nail acrylate allergy occurs from sensitization to acrylate monomers; 2-hydroxyethyl methacrylate (HEMA), 2-hydroxypropyl methacrylate, ethyl cyanoacrylate, and others have been identified as relevant allergens. Patch testing with HEMA and ethyl cyanoacrylate can screen for nail acrylate allergy. Avoidance is key, and we recommend less-permanent, acrylate-free nail polishes as alternatives.

Cutis. 2019;103:315-317.

In 2017, consumers spent an average of \$8.53 billion on nail services.¹ This booming industry is set to grow to more than \$15.5 billion by 2024.² Nail polishes and other nail cosmetic trends can present new exposures for consumers, including chemicals that can elicit allergic contact dermatitis. In this article, we discuss new nail trends and their associated allergens, the acrylates.

Tosylamide/Formaldehyde Resin

Traditionally, the most widely recognized nail polish allergen has been tosylamide/formaldehyde resin (TSFR).

However, there now are many touted TSFR-free nail polishes on the market, and the rate of positive reactions to this chemical has been declining in recent years. The North American Contact Dermatitis Group reported a positive reaction rate of 1.3% from 2005 through 2006,³ and rates decreased to 0.9% from 2015 through 2016.⁴ An Australian study demonstrated a similar reduction in positive reaction rates to nail polish chemicals, with only 0.7% of patients reacting to TSFR from 2014 to 2016 and 0% in 2017. It is theorized that this reduction occurred from replacing TSFR in traditional nail polishes with other chemicals such as polyester resins and cellulose acetate butyrate.⁵

Acrylate-Based Nail Treatments

Consumers recently have been gravitating toward acrylate-based nail treatments vs traditional nail polishes for a variety of reasons. Often referred to as gels, dips, or shellac, acrylate-based nail treatments represent a hot new trend in nail cosmetics. These manicures are resistant to chipping and scratches, creating a like-new look that lasts for weeks after application. The long-lasting nature of acrylate-based nail polishes has made them wildly popular with consumers.

Traditional acrylic nails consist of a powder polymer mixed with a liquid monomer, which polymerizes when a catalyst is added.⁶ The procedure is time consuming and can take up to 2 hours for application. In contrast, the newer gel manicure can be completed faster and includes application of acrylate-based nail polish, including a base coat, 2 coats of color, and a top coat. Exposure to either a light-emitting diode (30–60 seconds) or UVA (2 minutes) lamp is necessary after each coat is applied for polymerization (Figure 1).⁶ This long-lasting, semipermanent manicure typically is what patients are referring to when they say they have “gel nails.”

Gel dipping powders (referred to as dips) are another long-lasting acrylate-based nail treatment. This type of polish uses ethyl cyanoacrylate, a

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Dr. Atwater received an Independent Grant for Learning and Change from Pfizer, Inc. Dr. Reeder is a site investigator for AbbVie.

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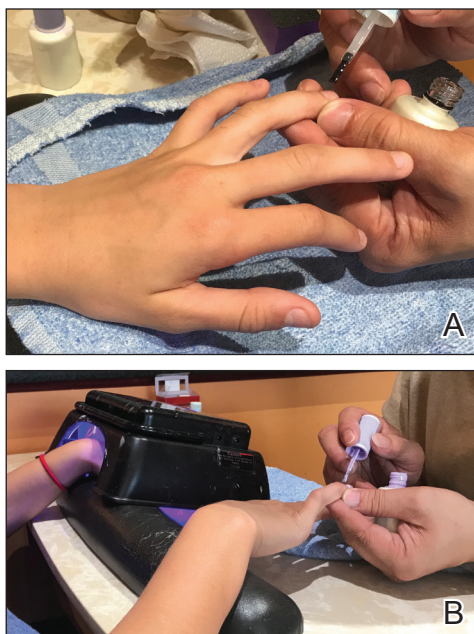


FIGURE 1. Gel manicure technique. A, Application of base coat. B, Polymerization of base coat using a light-emitting diode lamp (left) and application of first coat of color (right).



FIGURE 2. Gel dipping powder technique. A, Application of gel polish base coat. B, Application of dip powder to gel polish. Note the entire distal finger and nail are dipped into the powder. C, Shaping of the nail after the second coat of color is applied.

slightly different acrylate (yes, that IS super glue). After the nail is prepared, a base polish is applied to three-quarters of the nail and it is dipped into a natural color dip powder. The base polish is then applied to the entire nail, followed by a dip into the polish color of choice. This process is completed twice, followed by shaping and application of a top coat (Figure 2).

Finally, there are nail wraps, which are similar to stickers placed over or extending the nail plate. The wraps can be made from linen, silk, vinyl, or other material. Ethyl cyanoacrylate and isopropyl-2-cyanoacrylates have been identified in nail wrap adhesive.⁷ The heated product is directly applied to the prepared nail, and the excess wrap is filed off. Additional nail polish and a top coat usually are applied to finish the nail. Many of these products are available for in-salon use as well as online purchase and home application by consumers.

Acrylate Allergy

Patients who are allergic to acrylates can present with different patterns of dermatitis. Although the majority of patients present with dermatitis on the hands, fingers, or wrists, up to 10% may only have facial and neck dermatitis.⁸ Less commonly, the abdomen and thighs can be involved.^{6,8} Nail technicians most commonly present with pulpitis with cutaneous fissures.⁸ Other symptoms can include subungual hyperkeratosis, onycholysis, and nail dystrophy. Paresthesia, urticaria, and upper respiratory tract symptoms can occur but are less common.^{6,8}

Acrylate allergy typically is the result of sensitization to the acrylate monomers. In theory, gel nail acrylate

materials are polymerized following exposure to a light-emitting diode or UVA lamp; however, there likely is some incomplete polymerization, which can increase the risk for development of allergy. Allergen exposure can occur due to incorrect application of the light source; inadvertent monomer exposure, which occurs when nail technicians wipe extra acrylate off of a client's finger(s); or inadvertent application of acrylate monomers to objects in the nail technician's work environment.^{6,8}

Several acrylate nail allergens have been reported. Many studies have identified 2-hydroxyethyl methacrylate (HEMA) as the most common nail acrylate allergen.^{8,9} At least one study identified 2-hydroxypropyl methacrylate as the most common, with HEMA in second place.⁶ Other reported acrylate allergens have included ethylene glycol dimethacrylate, triethylene glycol dimethacrylate, methyl methacrylate, ethyl cyanoacrylate, 1,4-butanediol diacrylate, hydroxypropyl acrylate, and 2-hydroxyethyl acrylate.^{8,9}

The American Contact Dermatitis Society Core Allergen Series and the North American Contact Dermatitis Group screening series currently include HEMA, methyl methacrylate, ethyl acrylate, ethyl cyanoacrylate, and TSFR.^{4,10}

Of note, acrylates are not included in the thin-layer rapid use epicutaneous (T.R.U.E.) patch test (SmartPractice), so they will be missed if this series is used.¹¹ In the setting of suspected nail acrylate allergy, some authors recommend initial screening with HEMA and ethyl cyanoacrylate, with extended acrylate testing if both are negative.⁸

Upon patch testing with an acrylate series, patients frequently react to 2 or more acrylates and the reactions can be strong (++) or extreme (+++), which may represent cosensitization or cross-sensitization.⁸ The likelihood of cross-reactivity between acrylates is not clear, though it has been postulated that it is theoretically possible.⁶

An important pearl for patch testers using the chamber method is proper storage of acrylate allergens and assembly of trays prior to patch testing. Similar to all haptens, manufacturers recommend that acrylates should be stored in a refrigerator, but some authors suggest that acrylates should be stored in the freezer.¹² Acrylates are volatile chemicals and rapidly degrade when exposed to air. A methyl methacrylate preparation loaded into an inert quadrate (IQ) chamber and stored at room temperature showed a nearly undetectable amount of any residual methyl methacrylate 24 hours later. Refrigeration of allergens in chambers slowed but did not stop eventual degradation, with nearly all acrylate preparations reaching an undetectable level of allergen by day 8.¹³ Acrylates, along with other volatile allergens, should only be loaded into chambers immediately prior to placement on the patient.

Allergy Prevention

Prevention of nail acrylate allergy among consumers is simple: avoid contact with the offending allergen. Acrylate spillover (ie, applying the acrylate onto the skin) and direct contact with objects and working surfaces contaminated with acrylate-based nail products should be avoided.⁸ Avoidance is more complicated for nail technicians, but it is thought that nitrile gloves allow for the best dexterity and allergen avoidance when acrylate exposure is brief.¹⁴ Allowable exposure times with nitrile gloves may be 15 to 30 minutes. After this time passes, a glove change is required to avoid exposure.¹⁴ Wearing nitrile gloves for longer than 15 to 30 minutes will result in cutaneous exposure and risk for dermatitis in sensitized patients. If longer wear is desired, one option includes cutting the fingertips off of Silver Shield/4H gloves (Honeywell Safety Products USA, Inc), applying them to the distal fingers, and wearing a standard nitrile glove over top, known as the finger stall technique.⁶ In one study, this technique was recommended to nail technicians with acrylate allergy. A telephone survey conducted 4 to 43 months later confirmed that 36% (8/22) of participants were using the technique without symptoms. In this same study, 73% (16/22) had continued working as nail technicians.⁶

Acrylates are used for other medical purposes, including dental procedures, orthopedic procedures, surgical glues, wound dressings, and contact and intraocular lenses. They also have additional cosmetic applications,

including eyelash and hair extensions.⁸ Therefore, it is vital that patients disclose any history of acrylate allergy to both their medical and cosmetic providers.

Our Final Interpretation

Acrylate allergy has become increasingly common, and long-lasting nail treatments often are the culprit. Whether through gels, dips, or shellac, repeated exposure to acrylates through nail treatments can increase the risk for allergy. The T.R.U.E. test alone will not make the diagnosis, as acrylates are not present in this patch test system. It is important to remind your allergic patients that acrylates are present in other compounds used for medical and cosmetic purposes. Avoidance is key, and for allergic patients who love to bedazzle their nails, we suggest less-permanent, acrylate-free nail polishes as alternatives.

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