

# Bilateral Symmetric Onycholysis of Distal Fingernails

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A 28-year-old woman presented with distal onycholysis of all 10 fingernails. The patient started to notice brittleness in the first, second, and third fingernails of the right hand 2 months prior. She had a 10-year history of wearing acrylic nails and reported a history of periungual eczema. On physical examination, all 10 fingernails had distal onycholysis and there was a green discoloration of the

first fingernail on the left hand. On blood analysis, thyroid-stimulating hormone and free thyroxine were within reference range. A nail clipping showed onychodystrophy and a negative periodic acid–Schiff stain.

## What's the diagnosis?

- a. allergic contact dermatitis
- b. hypothyroidism
- c. lichen planus
- d. onychomycosis
- e. psoriasis

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## The Diagnosis: Allergic Contact Dermatitis

An allergic contact dermatitis (ACD) to acrylates was suspected and 4 patches were applied to the forearm (the North American Standard Series of the North American Contact Dermatitis Group). The patches were 2-hydroxyethyl methacrylate (2-HEMA) 2.0% permissible exposure limit (peL), ethyl acrylate 0.1% peL, tosylamide formaldehyde resin 10.0% peL, and methyl methacrylate 2.0% peL. A reading at 72 hours was performed and showed a positive reaction to hydroxyethyl methacrylate, ethyl acrylate, and methyl methacrylate, and a negative patch test to tosylamide formaldehyde resin (nail polish)(Figure). The patient was diagnosed with an allergic contact hypersensitivity to the aforementioned acrylates and instructed to avoid artificial nails and acrylate glues. She also was started on oral biotin supplements. On 6-month follow-up the patient had regrowth of all 10 fingernails without brittleness or splitting. She was able to use nail polishes but avoided all acrylic artificial nails and acrylate-containing personal care products.

### Acrylate Allergy and Artificial Nails

Acrylates are plastic materials formed by polymerization of acrylic or methacrylic acid monomers and have been cited as a major cause of occupational and nonoccupational contact dermatitis. Contact dermatitis to acrylates in artificial nails was first reported in the 1950s.<sup>1,2</sup> Products containing 100% methyl methacrylate monomers in acrylic nails were banned by the US Food and Drug Administration in the early 1970s after receiving a number of complaints.<sup>3</sup> However, no regulation prohibits the use of methyl methacrylate monomer in cosmetic products, and various methacrylate and acrylate monomers remain widely used.<sup>4</sup> With a growing popularity in artificial nails, it is expected the number of sensitized persons will increase.

Acrylate allergy from sculptured nails concern self-curing resins made from a polymer powder and a liquid monomer solution. Advantages of new UV-cured products include the lack of unpleasant smell and simplified modeling. They also do not require an irritant, such as methacrylic acid, as a bonding agent. Instead, 2-HEMA and 2-hydroxypropyl methacrylate are added. These photobonded nails colloquially are called gel nails (acid free) as opposed to acrylic nails (using methacrylic acid as a primer). It is important to note that the esters of acrylic acid but not the acid



Results of patch testing for acrylates at 72 hours. First well: 1+ reaction, 2-hydroxyethyl methacrylate; second well: 1+ reaction, ethyl acrylate; third well: negative reaction, tosylamide formaldehyde resin (nail polish); fourth well: 1+ reaction, methyl methacrylate. 1+ indicates positive reaction.

itself sensitize patients, and sensitization is not caused by the uncured gel or the monomer solution but by the remaining monomers in the cured plastic nail and the dust filings that are produced during the finishing process.

### Clinical Presentation

Symptoms of an ACD to nail acrylates include pruritus and fingertip dermatitis along with nail plate dystrophy. There may be pruritus at the nail base, with subsequent dryness, thickening, and onycholysis. The brittle nails may become split, discolored, and develop paronychia. Inadvertent contact with glue monomers or other acrylate-containing substances may cause eczematous lesions at distant sites. Avoidance of the allergen often results in complete restoration of the normal nail and fingertip within months.

### Sensitization

Acrylates and methacrylates are ubiquitous materials used for both industrial and commercial applications. Due to their widespread industrial use, contact

allergies to acrylates including 2-HEMA, 2-hydroxypropyl methacrylate, and triethylene-glycol diacrylate (TREGDA) are common. Cross-reaction of these compounds has been observed and is postulated to be due to reaction of the (meth)acrylate carboxyethyl group with the receptors of antigen-presenting cells.<sup>5</sup> As a result, an individual with an acrylate allergy sensitized to one allergen often is allergic to its similar compounds and cross-reactors and must avoid the assortment of compounds containing these ingredients, which is important for individuals with occupational sensitization to a particular acrylate who is subsequently susceptible to other acrylate-containing compounds triggering allergic reactions when reexposure occurs in different settings.

### Allergens and Occupational Exposure

Acrylates in cosmetic nail products are a source of ACD for not only the customer but also the manicurist.<sup>6</sup> The most frequently cited sources of ACD in beauticians are acrylate chemicals.<sup>7</sup> However, acrylate compounds are an occupational hazard for a number of other specialists, including dentists and dental technicians, histology technicians, and individuals in the printing industry.<sup>8,9</sup> Other individuals may be sensitized to acrylates through their inclusion in adhesives, dental bonding agents, hearing aids, electrocardiogram electrodes, artificial bone cement, and a myriad of other medical and nonmedical applications.<sup>4,10-12</sup> For workers who cannot avoid occupational exposure to these allergens, polyvinyl alcohol and multilayer laminate gloves are recommended, as natural rubber latex gloves do not always provide adequate protection from many of these agents.<sup>10</sup>

### Testing for Suspected Acrylate Allergy

Cross-reactivity among acrylates is widely considered in the literature but remains enigmatic and is an important consideration with regard to routine patch test screening.<sup>13</sup> In the case of an acrylate allergy to nail products, using 2-HEMA and ethylene glycol dimethacrylate is effective in detecting sensitization by photobonded nails and in patients sensitized by powder liquid products.<sup>14</sup> One study showed a patch test panel including 2-HEMA, ethylene glycol dimethacrylate, and TREGDA was effective in identifying the majority of individuals with an allergy to acrylates in nail products and nail technicians.<sup>15</sup> Another study has shown the most commonly positive testing allergens to be HEMA, ethyl acrylate, and methyl methacrylate.<sup>16</sup> If one is patch testing only one chemical, it appears 2-HEMA is preferred.<sup>17</sup> However, broader panels of screening allergens are necessary to achieve an accurate diagnosis. Furthermore, different panels of test allergens have been shown to vary in

their ability to detect an acrylate allergy in different occupational exposures.<sup>12</sup>

The time to patch test read also is important. A standard read at 72 hours is warranted; however, one study showed if only one read at day 3 was done without a subsequent day 7 read, then 25% of TREGDA and 50% of 2-HEMA allergies would have been missed in patients with occupational acrylate allergy.<sup>15</sup> Other studies have reported late-appearing and long-lasting test reactions when testing for an acrylate allergy.<sup>18,19</sup> Clinicians should be cognizant that an acrylate allergy may be present even if initial screening is negative but the history and clinical picture are suggestive.

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