

# Allergic Contact Dermatitis, Allergic Airborne Dermatitis, and Occupational Asthma Caused by (meth)acrylates in Artificial Nails

Iva Kolar, Suzana Ljubojević Hadžavdić

<sup>1</sup>Department of Dermatology and Venereology, University Hospital Center Zagreb, University of Zagreb School of Medicine, Zagreb, Croatia

## Corresponding author:

Professor Suzana Ljubojević Hadžavdić, MD, PhD  
Department of Dermatology and Venereology  
University Hospital Center Zagreb  
University of Zagreb School of Medicine  
Zagreb, Croatia  
[suzana.ljubojevic@gmail.com](mailto:suzana.ljubojevic@gmail.com)

Received: March 28, 2022

Accepted: September 1, 2022

**ABSTRACT** Allergic contact dermatitis (ACD) caused by (meth)acrylates is traditionally an occupational disease among dentists, printers, and fiberglass workers. With the use of artificial nails, cases have been reported both in nail technicians and in users. ACD caused by (meth)acrylates used in artificial nails is a relevant problem for both nail artists and consumers. We present the case of a 34-year-old woman who was working in a nail art salon for two years prior to the appearance of severe hand dermatitis, especially on her fingertips together, with frequent appearance of face dermatitis. The patient had artificial nails for the last 4 months because her nails were more prone to splitting, so she was regularly using gel to “protect” them. While she was at her workplace, she reported multiple episodes of asthma. We performed patch test to baseline series, acrylate series, and the patient’s own material. In the baseline series, the patient had positive reactions to nickel (II) sulfate (+++/++/+), fragrance mix (+/+/+), and carba mix (+/+/+), 2-hydroxyethyl methacrylate (2-HEMA) (+++/++/+), ethylene glycol dimethylacrylate (EGDMA) (+++/++/+), hydroxyethyl acrylate (HEA) (+++/++/+), and methyl methacrylate (MMA) (+/+/+). Semi-open patch test was positive to 11 of the patient’s own items (10 out of 11 were made of acrylates). There has been a significant increase in the incidence of acrylate-induced ACD among nail technicians and consumers. Cases of occupational asthma (OA) induced by acrylates have been described, but respiratory sensitizations of acrylates are still insufficiently investigated. Timely detection of sensitization to acrylates is primarily necessary in order to prevent further exposure to allergens. All measures should be taken to prevent exposure to allergens.

**KEY WORDS:** contact allergic dermatitis, (meth)acrylates, artificial nails, occupational asthma

## INTRODUCTION

Acrylates and methacrylates ((meth)acrylates) are synthetic thermoplastic resins formed by the polymerization of acrylic or methacrylic acid reactive monomers and have widespread use including in artificial acrylic nails (1). (Meth)acrylates are strong irritants and have high sensitizing potential, and they some-

times cause severe occupational as well as nonoccupational allergic contact dermatitis (ACD) in those exposed to their monomers (1). ACD caused by (meth)acrylates is traditionally an occupational disease among dentists, printers, and fiberglass workers and in both nail artists and consumers. Nail technicians

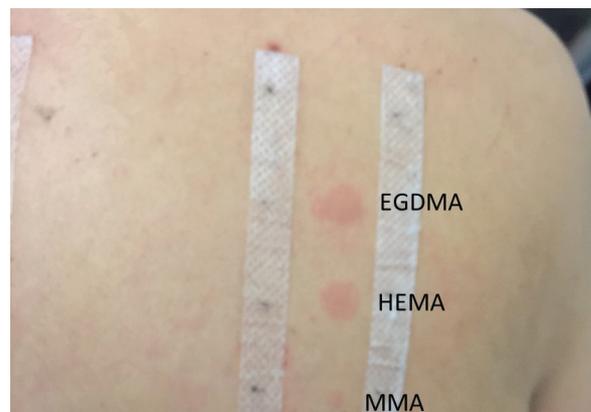
represented 80% of occupational acrylate-induced ACD. Hydroxyethyl methacrylate (HEMA) sensitivity is the most common among (meth)acrylates (2, 3). The use of methyl methacrylate (MMA) was restricted because of its well-known sensitizing potential (1). Isobornyl acrylate (IBOA) is an acryl monomer that causes ACD from adhesives/glues in diabetic devices (3-5). The number of occupational asthma (OA) cases caused by respiratory sensitizations from acrylates is increasing (6,7). The global artificial nails industry is growing, and the number of acrylate-sensitized patients is rising, leading to a significant and increasing problem of acrylate-induced ACD in both consumers using acrylate nails and those working with them (8-10).

### CASE REPORT

A 34-year-old woman who had been working in a nail art salon for past 2 years, was referred to our Department with severe hand dermatitis, especially on her fingertips (Figure 1), together with facial dermatitis. The patient had artificial nails for the last 4 months because her nails were prone to splitting, so she was regularly using a gel to “protect” them. The patient also had multiple episodes of asthma that had been occurring exclusively in her workplace a few months before admittance to our Department. Despite usage of protection (a face mask, nitrile gloves) and a ventilated table, the patient’s clinical manifestations as well as respiratory manifestations kept reoccurring. We performed a patch test with baseline series, acrylate series, and the patient’s own materials (gloves, mask, nail cosmetics). Patch test showed positive



**Figure 1.** Chronic hand eczema with pulpitis in a beauty technician and acrylic nail user.



**Figure 2.** Positive patch test reaction on day 3 to ethylene glycol dimethylacrylate (EGDMA) (++) and 2-hydroxyethyl methacrylate (2-HEMA) (++) on the patient's back. Ethyl methacrylate (MMA) (+) and hydroxyethyl acrylate (HEA) (++) were also positive.

reactions to nickel (II) sulfate day (D) 2 (++) and D3 (++) and D7 (++) and fragrance mix D2 (-), D3 (-), D7 (+), carba mix D2 (-), D3 (-), D7 (+), ethylene glycol dimethylacrylate (EGDMA) D2 (++) and D3 (++) and D7 (++) and methyl methacrylate (MMA) D2 (+), D3 (+), D7 (+), 2-hydroxyethyl methacrylate (2-HEMA) D2 (++) and D3 (++) and D7 (++) and hydroxyethyl acrylate (HEA) D2 (++) and D3 (++) and D7 (++) (Figure 2). Semi-open patch test was positive to 11 of the patient’s own items (10 out of 11 were made of acrylates). The patient was treated with topical corticosteroid creams together with neutral creams. We recommended avoidance of substances that the patient tested positive for, together with use of proper protection. On prescribed therapy, there was partial regression of the patient’s skin lesions, but since her breathing problems did not improve, she changed her job. The new job was working in a beauty salon, without contact with acrylates and using adequate protection. A few months later, both skin and respiratory system symptoms disappeared completely (Figure 3).



**Figure 3.** Complete regression of hand eczema a few months after a workplace change.

## DISCUSSION

Acrylates in their monomer states are strong irritants and have high sensitizing potential. The polymerized states of acrylates are relatively inert and are usually non-sensitizing because of their high molecular weight (1). However, in polarized acrylates we can almost always find separate active monomers and they also may therefore have sensitizing potential (1). In many studies, HEMA identified about 90% of cases and can be considered a good screening allergen for acrylates allergy (11). In study from Gregoriou et al., contact allergy to acrylates was found in 72.4% nail technicians or nail product users, of which 88.5% nail technicians were occupationally exposed (11). The most common sensitizer in nail technicians were HEMA and EGDMA (11). In 2019, HEMA was included in the European baseline series due to the frequent reports of contact allergy (12).

Previous studies have reported significant cross-reactions to 2-HPMA, 2-HEMA, and EGDMA. Cross-reactions between cyanoacrylates and (meth)acrylates are not shown (5). Therefore, patients should be recommended to avoid all acrylates if they had a positive patch test to at least one acrylate, to minimize the risk of cross-reactions (1,11,13,14).

Our patient had a worsening of respiratory problems after exposure to acrylates, despite the use of a facial protective mask and a ventilated table. Cases of occupational asthma (OA) induced by acrylates have been described, but respiratory sensitization of acrylates is still insufficiently investigated, and the mechanism of acrylate-induced asthma is still unknown (15). Acrylate-induced OA presents different immune mechanisms, such as hypersensitivity type IV reaction, compared with mechanisms that induce asthma by other low-molecular-weight agents such as hypersensitivity type I (6,7).

Wearing gloves should reduce acrylates from permeating and contacting the skin and thus protect against sensitization. However, in most cases, wearing gloves alone is not enough. It is very important to change them regularly and use them for a single use only. However, not all gloves provide adequate protection, as many studies have shown the ineffectiveness of latex gloves on acrylates (1). Some acrylates (MMA, 2-HEMA, TREGDMA) will cross through latex gloves within 1 to 3 minutes and through vinyl gloves in 5 to 8 minutes, so double gloving is recommended (1,5). With nitrile gloves, protection from acrylate sensitization is relatively good, but they need to be changed regularly and not used longer than 30 minutes (1,11). When there is exposure of acrylates to ultraviolet (UV) light, it is recommended to wear

double nitrile gloves for no longer than 30 minutes (1,11). The most effective protection is offered by the 4H (ethylene-vinyl alcohol-polyethylene) gloves, but they are not very practical for nail technicians because of their lack of flexibility (1,11). Sometimes it is impossible to completely prevent contact with the allergen for various reasons, such as inaccessible nail product safety datasheets. The mainstay of ACD management is the avoidance of exogenous agents proved relevantly positive in patch test or, if possible, substitution with non-allergic agents (10). Nail technicians should employ appropriate safety measures, including the use of a facial mask and wearing adequate protective gloves which should be changed frequently (1,16). If the symptoms of OA develop, transfer to another workplace should be considered. For patients with acrylate ACD with acrylate OA who remain in exposure, ongoing medical surveillance should be provided (6).

## CONCLUSION

There has been significant increase in the incidence of acrylate-induced ACD among nail technicians and consumers. Timely detection of sensitization to acrylates is primarily necessary in order to prevent further exposure to allergens. All measures should be taken to prevent exposure to allergens. Nail technicians must be educated about work safety, which gloves to use, and on appropriate glove-changing frequency. Sometimes a change of profession is also necessary because avoidance is the only certain and safe way to prevent disease.

## References:

1. Sasseville D. Acrylates in contact dermatitis. *Dermatitis* 2012;23:6-16.
2. DeKoven S, DeKoven J, Holness DL. (Meth)Acrylate Occupational Contact Dermatitis in Nail Salon Workers: A Case Series. *J Cutan Med Surg*. 2017;21:340-4.
3. Militello M, Hu S, Laughter M, Dunnick CA. American Contact Dermatitis Society Allergens of the Year 2000 to 2020. *Dermatol Clin*. 2020;38:309-20.
4. Aerts O, Herman A, Mowitz M, Bruze M, Goossens A. Isobornyl Acrylate. *Dermatitis*. 2020;31:4-12.
5. Gardeen S, Hylwa S. A review of acrylates: Super glue, nail adhesives, and diabetic pump adhesives increasing sensitization risk in women and children. *Int J Womens Dermatol*. 2020;6:263-7.
6. Sauni R, Kauppi P, Alanko K, Henriks-Eckerman

- ML, Tuppurainen M, Hannu T. Occupational asthma caused by sculptured nails containing methacrylates. *Am J Ind Med.* 2008;51:968-74.
7. Suojalehto H, Suuronen K, Cullinan P, Lindström I, Sastre J, Walusiak-Skorupa J, *et al.* European Network for the Phenotyping of Occupational Asthma (E-PHOCAS) investigators. Phenotyping Occupational Asthma Caused by Acrylates in a Multicenter Cohort Study. *J Allergy Clin Immunol Pract.* 2020;8:971-9.
  8. Montgomery R, Stocks SJ, Wilkinson SM. Contact allergy resulting from the use of acrylate nails is increasing in both users and those who are occupationally exposed. *Contact Dermatitis.* 2016;74:120-2.
  9. Uter W, Werfel T, Lepoittevin JP, White IR. Contact Allergy—Emerging Allergens and Public Health. *Int J Environ Res Public Health.* 2020;17:2404.
  10. Schalock P. Common allergens in allergic contact dermatitis. UpToDate. Available at: <https://www.uptodate.com/contents/common-allergens-in-allergic-contact-dermatitis> Accessed: February 24, 2022.
  11. Gregoriou S, Tagka A, Velissariou E, Tsimpidakis A, Hatzidimitriou E, Platsidaki E, *et al.* The Rising Incidence of Allergic Contact Dermatitis to Acrylates. *Dermatitis.* 2020;31:140-3.
  12. Wilkinson M, Gonçalo M, Aerts O, Badulici S, Ben-nike NH, Bruynzeel D, *et al.* The European baseline series and recommended additions: 2019. *Contact Dermatitis.* 2019;80:1-4.
  13. Spencer A, Gazzani P, Thompson DA. Acrylate and methacrylate contact allergy and allergic contact disease: a 13-year review. *Contact Dermatitis.* 2016;75:157-64.
  14. Uter W, Geier J. Contact allergy to acrylates and methacrylates in consumers and nail artists - data of the Information Network of Departments of Dermatology, 2004-2013. *Contact Dermatitis.* 2015;72:224-8.
  15. Suojalehto H, Suuronen K, Cullinan P, Lindström I, Sastre J, Walusiak-Skorupa J, *et al.* Phenotyping Occupational Asthma Caused by Acrylates in a Multicenter Cohort Study. *J Allergy Clin Immunol Pract.* 2020;8:971-9.e1.
  16. Kalenge S, Kirkham TL, Nguyen LV, Holness DL, Arrandale VH. Skin Exposure to Acrylates in Nail Salons. *Ann Work Expo Health.* 2021;65:162-6.

