

Sensitization to Acrylates in Varnishes

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Varnishes are liquid products that solidify when exposed to air. They are used to cover, protect, and embellish surfaces. Varnishes contain agglutinants and volatile solvents. The main agglutinants are epoxy resins and acrylates, and these acrylates are the substances that produce sensitization most of the time. We explain the use and handling of these varnishes and present four cases of occupational sensitization to acrylic resins present in wood varnishes used by four workers.

PAINTS AND VARNISHES are liquid products that solidify when exposed to air. They are applied to surfaces to make a dry coating for protective and decorative purposes. The constituents of varnishes are very similar to those of paints (eg, binders, solvents, and additives), but varnishes lack pigments.¹

The binder (resin) gives the paint its more important properties, such as hardness, flexibility, and speed of drying. Naturally drying oils, alkyds, epoxy resins, formaldehyde resins, vinyl resins, acrylic resins, urethane resins, and other synthetic resins are some of the more frequently used binders. Solvent is the volatile component of a paint or varnish and is used to make the product's consistency suitable for application.¹

There are few reports about the prevalence of dermatitis among persons who work professionally with paints and varnishes. Dermatitis among painters and varnishers was investigated for the first time in 1947, by Pirila. He found a prevalence of dermatitis in 6.5% of these workers. Hogberg and Wahlberg observed a prevalence of 3.9% for contact dermatitis among painters.^{1,2}

Among these workers, irritant contact dermatitis may be more common than allergic contact dermatitis² and is usually located on the dorsal aspects of the hands and arms.³ The broken epidermis, caused by irritation from the product, may promote sensitization to paint and varnish compounds and hence cause an allergic contact dermatitis (ACD). Lesions of ACD can occur on sites of accidental splashes or affect other areas of the body by way of contaminated hands, clothes, or tools.¹

Since the 1970s, synthetic resins have replaced turpentine as the most important cause of sensitization to paints. Among synthetic resins, epoxy resins are the ones most frequently implicated in contact dermatitis although there are several reports of ACD caused by acrylic resins.⁴⁻⁶ Varnishes are causative agents of ACD caused by epoxy resin.⁷ This article presents four cases of sensitization to acrylates among patients who work with varnishes.

Case Reports

Case 1

A 33-year-old woman with no prior skin disease presented with a history of erythematous itching exudative lesions followed by scaling, affecting the flexor surfaces of the forearms, abdomen (Fig 1), right thigh, and both cheeks. Ten



Figure 1. Eczema on the abdomen of the patient described in Case 1, after she worked with a new varnish.

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days previously, she had begun working with new varnishes (Kupsaviol and Kupsirol, Industrias Químicas Kupsa, Logroño, Spain) containing tripropylene glycol diacrylate, 203 acrylate, and glycerol propoxy triacrylate. She used gloves for skin protection. She gave up handling the varnish after presenting at the clinic and was treated with topical corticosteroids. The lesions disappeared 2 weeks later.

Patch tests were performed with the standard battery of the Grupo Español de Investigación de Dermatitis de Contacto (GEIDC) and with the acrylate series supplied by Chemotechnique Diagnostics (Malmö, Sweden). Readings

were performed at day 2 and day 4, according to the accepted criteria of the International Contact Dermatitis Research Group (ICDRG). The test results were positive for several acrylates, including tripropylene glycol diacrylate (Table 1).

Case 2

A 41-year-old man with no prior skin disease presented with a history of eczema on the flexor surface of the right forearm, the front part of both thighs (Fig 2), and the right side of the

Table 1. Results of Patch Tests with Acrylates at Day 4

Allergen	Reactions			
	Case 1	Case 2	Case 3	Case 4
Ethyl acrylate 0.1%	—	++	—	—
Butyl acrylate 0.1%	—	+	—	—
2-Ethylhexyl acrylate 0.1%	—	—	—	—
2-Hydroxyethyl acrylate 0.1%	++	++	++	—
2-Hydroxypropyl acrylate 0.1%	++	++	++	++
Methylmethacrylate 2%	—	—	—	—
Ethylmethacrylate 2%	—	—	—	—
N-Butyl methacrylate 2%	—	—	—	—
2-Hydroxyethyl methacrylate 2%	—	—	++	—
2-Hydroxypropyl methacrylate 2%	—	—	++	+
Ethylene glycol dimethacrylate 2%	—	—	—	—
Triethylene glycol dimethacrylate 2%	—	—	—	—
1,4-Butanediol dimethacrylate 2%	—	—	—	+
Urethane dimethacrylate 2%	—	—	—	—
Bis-EMA 1%	—	—	—	—
Bis-MA 2%	—	—	—	—
Bis-GMA 2%	—	—	—	—
1,4-Butanediol diacrylate 0.1%	—	—	—	—
1,6-Hexanediol diacrylate 0.1%	++	+++	++	++
Diethylene glycol diacrylate 0.1%	++	+++	++	++
Tripropylene glycol diacrylate 0.1%	+	—	—	—
Trimethylopropane triacrylate 0.1%	—	—	—	—
Pentaerythritol triacrylate 0.1%	—	—	—	—
Oligotriacrylate 480 0.1%	—	—	—	—
Epoxy acrylate 0.5%	—	—	—	—
Urethane diacrylate (aliphatic) 0.1%	—	—	—	—
Urethane diacrylate (aromatic) 0.05%	—	—	—	—
Triethylene glycol diacrylate 0.1%	++	+++	+	—
N,N-Methylene bisacrylamide 1%	—	—	—	—
Tetrahydrofurfuryl methacrylate 2%	—	—	—	—
Ethyl cyanoacrylate 10%	—	—	—	—
Tetraethylene glycol dimethacrylate 2%	—	—	—	—
N,N-Dimethylaminoethyl methacrylate 0.2%	—	—	—	—

Bis-EMA = Ethoxylated bisphenol A dimethacrylate; Bis-GMA = 2,2-bis[4-(2'-hydroxy-3'-methacryloxypropoxy)phenyl]propane; Bis-MA = 2,2-bis[4-(methacryloxy)phenyl]propane.



Figure 2. Eczema on the thighs of the patient described in Case 2, after he used an acrylic varnish.

trunk. Fifteen days previously, he had been working in a varnish plant, wearing rubber gloves. He had been working with dipropylene glycol diacrylate (10% in petrolatum) and had used only his right hand when varnishing. He was treated in the same way as was the patient described in Case 1, and his lesions disappeared in 1 week.

Patch testing was performed as with the patient in Case 1. Sensitization to several acrylates was found (see Table 1).

Case 3

A 40-year-old man with no prior skin disease presented with a history of eczema on the waist and on the right knee. The eczema had appeared a few days after casual contact with new varnishes (Kupsaviol and Kupsiol). He worked as a wood varnisher at the same workplace at which the patient of Case 1 worked, and he used rubber gloves for skin protection. His patch-test results were positive for various acrylates (see Table 1).

Case 4

A 28-year-old man with no prior skin disease presented with a 15-day history of intensely itchy erythematous exudative lesions on his forearms, thighs, knees, and abdomen. He worked as a door varnisher and had used a new varnish (Valpol, Valresa, Spain) that contained dipropylene glycol diacrylate and tripropylene glycol diacrylate. His eczema resolved after he began avoiding contact with the varnish.

The patient was patch-tested with the same allergens used for patch-testing the other three patients. We observed positive reactions to nickel sulfate (past relevance) and to several acrylates (see Table 1).

Discussion

Acrylic polymers are extremely versatile and range from flexible-weight elastomers to hard thermostable plastics. There is a great variety of acrylic monomers, so it is possible to produce many different polymers that will produce plastics with different properties and applications.

ACD due to acrylates has been well documented. The highest index of sensitization to acrylates is found among dental professionals, but there are also cases among painters and other professionals who use varnishes and lacquers.^{1,4-6}

Some acrylates have high sensitization and irritant capacities that are difficult to distinguish clinically. Studies with guinea pigs have demonstrated that diacrylates are strong irritants, monoacrylates are moderate irritants, and monomethacrylates and dimethacrylates have no or only weak irritant capacity.^{8,9} Monoacrylates have strong sensitization potential, but monomethacrylates are moderate sensitizers. In the group of multi-functional acrylates, diacrylates and triacrylates are strong sensitizers.⁸

The interpretation of the patch-test results for our patients can be difficult owing to numerous positive reactions to many acrylates that were not described in the Material Safety Data Sheets for the products used at their workplaces. This can be explained by the possibility of cross-reaction between different acrylates.^{5,6,8,10} It is also possible that the products the patients used at work contained undeclared acrylates, most of which could be contact sensitizers as shown in the study by Henriks-Eckerman and Kanerva.¹¹

Individuals who work with acrylates professionally should use adequate protective clothes, shoes, gloves, masks, and glasses because of the strong sensitization potential of acrylates.

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