

flavourings as well as fragrances, especially those allergic to cinnamic aldehyde.

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Sensitization to triglycidyl isocyanurate, epoxy resins and acrylates in a developmental chemist

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Key words: allergic contact dermatitis; triglycidyl isocyanurate; epoxy resins; (meth)acrylates; occupational; laboratory workers; UV-cured printing inks. © Munksgaard, 1999.

Case Report

A 49-year-old chemist, with a long history of atopic dermatitis, had worked for 15 years on the development of solder-resistant inks for circuit boards. These inks were cured by both heat and UV radiation. He had been in his job for 5 years before developing dermatitis of the hands and forearms. Patch testing at that time revealed allergic reactions to methylene bisacrylamide and ethylhexyl acrylate. He continued to work in the same environment, successfully limiting exposure to these sensitizers and with resolution of his symptoms. However, 10 years later, he was re-referred to the contact dermatitis investigation unit with an exacerbation of his eczema, which was now also affecting his face.

Patch testing to a standard series, epoxy resin series, phenol-formaldehyde series, selected acrylic monomers from a printing series (Chemotechnique) and materials handled at work by the patient was performed. Positive reactions are recorded in Table 1.

Discussion

Triglycidyl isocyanurate (TGIC), CAS 2451–62–9, is a triazine epoxy compound derived from epichlorohydrin and isocyanuric acid. It is used as a hardener in thermosetting 1-component polyester powder paints. It is also used in electrical insulation materials, resin moulding systems, laminated sheetings and inks. Cases of allergic contact dermatitis have previously been reported during the manufacture and handling of the compound (1–3). TGIC has also been associated with the development of occupational asthma (4).

The application of a solder-resistant coating is an important stage in the manufacture of circuit boards. This involves the application of epoxy resin or acrylate inks to the boards, which are then cured by heat or UV light. Photosensitive inks are increasingly being used in industry. Their main advantage is increased speed of drying, which in turn allows ease of handling and storage. However, they contain numerous potential sensitizers, including acyclic monomers (both polyfunctional and monofunctional), epoxyacrylates and photoinitiators. 1 previous case of contact allergy to TGIC in UV-curable printing inks in the manufacture of circuit boards has been described (5). Our patient came into contact with epoxy resins, acrylates and TGIC, both in the development of the inks from raw materials and in the application of these inks to the circuit boards, and thus some of his positive results imply concomitant sensitization rather than cross-reactivity. He has remained with the same company, with less active involvement in the development side, and still suffers flares of his dermatitis if

Table 1. Positive patch test results

	D2	D4
<i>Standard series</i>		
epoxy resin 1% pet.	++	+
<i>Epoxy series</i>		
cycloaliphatic epoxy resin 0.5% pet.	++	++
<i>Acrylate/print series</i>		
2-hydroxyethyl acrylate (0.1% pet.)	++	++
ethyleneglycol dimethacrylate (2% pet.)	+	+
triethyleneglycol dimethacrylate (2% pet.)	++	++
diethyleneglycol diacrylate (0.1% pet.)	++	++
epoxy acrylate (0.5% pet.)	+	++
triethyleneglycol diacrylate (0.1% pet.)	++	++
N,N-methylenebisacrylamide (1% pet.)	++	++
<i>Materials handled by patient</i>		
carboxylated epoxy acrylate in methoxypropylacetate (0.1% pet.)	+	+
epoxy novolac acrylate with trimethylolpropane triacrylate (0.1% pet.)	+	+
TGIC with epoxy acrylates (0.1% pet.)	++	++
TGIC 0.1% pet. (>99% pure)	++	++

25 control subjects showed no positive reactions.

he inadvertently comes into contact with the allergens identified.

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A protocol to investigate the blockade of jellyfish nematocysts by topical agents

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The Chesapeake Bay and the US coast from New England to the Gulf of Mexico is the habitat of *Chrysaora quinquecirrha* (sea nettle), whose medusa appears at the height of summer. It has been estimated that over a million sea nettle stings occur in the area annually (1). Another jellyfish, *Physalia physalis* (Portuguese man-of-war), is responsible for serious stings worldwide, especially in southeastern Florida during the Christmas vacation.

Because cutaneous pain occurs immediately after tentacles contact skin and significant toxic or allergic sequelae occur after jellyfish stings (1), skin protection cream might ameliorate the sting. Using scanning electron microscopy to study nematocyst discharge on human cadaver skin in vitro, using another jellyfish, *Cyanea capillata*, Heeger et al. (2) reported that topical applications had a beneficial effect. Other investigators found that a thick film of petrolatum protected bathers from *Chrysaora* stings, but the thickness was not cosmetically acceptable (3). A standard in vitro test is required to screen topical agents for protection of human skin from jellyfish stings.

Adult, healthy volunteers were selected, excluding those who were pregnant or had skin diseases, alcoholism, skin product sensitivity, drug addiction, recent (24-h) ingestion of any oral/topical analgesic or antihistamine. The protocol and selection of patients was approved by our Human Volunteers' Committee.

Narrow, large polyethylene bags (53×19 cm) were placed as sleeves over the arms of volunteers to the mid-biceps region and fixed in place with paper tape (Dura-pore®). 2, 5 cm×5 cm treatment sites (1 near the elbow and 1 near the wrist) were cut out of the bags over each volar forearm. The edges of all windows were reinforced

with paper tape to prevent tentacles from slipping under the bag and stinging skin outside areas of treatment.

3 test solutions and 1 control were applied to the windows of each volunteer with an (50 µl) automatic pipette and spread manually with a finger protected by a rubber finger cot to achieve an even film. This volume was used over the skin area to achieve an application density of 2 µl/cm² – a standardized amount used to test the efficacy of sunscreen products (4). After treatment, sites were air-dried for 15 min.

Each arm was then submerged in a 45-litre salt-water aquarium, while tentacles of a freshly collected (<18 h) *Chrysaora* medusa were gently rubbed onto exposed treatment sites for 15 s per window. After the 4 windows of skin were exposed, the bags were removed. Pain was recorded at any time after initiation of tentacle contact, and treatment sites were examined for visible skin response after the bag was removed and again 30 min later. In the case of *Chrysaora*, less than 1% of patients objected to the intensity of pain felt when stung. Urticarial eruptions, when they occurred, persisted for 30 min to 4 h and pigmentation lasting longer than 24 h was observed in less than 1% of patients. Eruptions and pain were scored on a scale of trace, mild and severe, and the correlation between pain and eruption was approximately 80%.

5 persons conducted trials on 30 to 35 patients per day, accepting 4 patients every 45 min. 1 person applied and organized the distribution of the solutions and treated all the patients. 1 person recorded the data and compiled the paperwork, while the other 3 bagged, stung and later examined all patients for skin responses. The system could also be adapted for use in nature, by applying the bags over legs and wading into medusae or by