Ectopic contact dermatitis from ethyl cyanoacrylate instant adhesives

ROLAND R. TOMB1, JEAN-PIERRE LEPORITIEN2, FRANÇOIS DUREPAIRE1 AND EDOUARD GROSSHANS1

1Consultation de Dermato-allergie, Clinique Dermatologique, Hôpital Civil, 1, Place de l'Hôpital, F-67091 Strasbourg, France
2Laboratoire de Dermatochimie associé au CNRS, Université Louis Pasteur, Clinique Dermatologique, CHRU, F-67091 Strasbourg, France

Although allergic reactions to cyanoacrylate adhesives are extremely rare, they should not be considered impossible. We report a young hairdresser who developed an occupational allergic contact dermatitis to 2 "instant glues" used to attach false hair. The eczematous eruption involved the fingers and face slightly but mainly the eyelids. Patch test reactions were strongly positive to ethyl cyanoacrylate adhesives.

Key words: acrylates; adhesives; allergic contact dermatitis; ethyl cyanoacrylate; eyelids; hairdresser; occupational.

Accepted for publication 30 August 1992

Ectopic contact dermatitis from ethyl cyanoacrylate instant adhesives

Cyanoacrylates are widely used as "instant" contact adhesives for metal, glass, rubber and plastics, and also in surgery to bind tissues and to seal wounds (1–3). Within the group of acrylate compounds, they possess unusual qualities: they polymerize almost instantaneously in air at room temperature and bond immediately and strongly to surface keratin (1). Because of this feature, many authors (1, 3) have considered allergic reactions virtually impossible but contact dermatitis may occur from these instant glues, though it is extremely rare. We report an unusual case of allergy involving principally the eyelids.

Case Report
A 20-year-old female hairstylist presented with acute periorbital eczema and marked edema of the eyelids. Her lip commissures were erythematous and scaly. She also complained of a chronic dry eczema of her fingertips. We prescribed symptomatic treatment (including topical corticosteroids) and planned patch testing later. She rapidly improved but a dramatic turn made the patient return sooner than initially scheduled, with a severe and spectacular recurrence of eczema on her eyelids; she could hardly manage to open her eyes (Fig. 1). The dermatitis had relapsed within 24 h of returning to work. Considering this recurrence and the absence of use of cosmetics, occupational allergic contact dermatitis was suspected. The patient had been working for 18 months in a hair beauty shop where her job consisted of attaching pieces of false hair to bald scalps. She had to knot the edge of the wig onto the customer's remaining hair, stick the knot to the false hair matrix with a special glue, then fix the headdress with a hair spray. She used 2 brands of cyanoacrylate instant glues (DSA Bergman* and Cyanolit* Eleco) and never wore gloves.

After clearing of her dermatitis, patch testing was carried out with occupational materials (glues, hair spray, hairdressing series) along with the European standard series and toluenesulphonamide formaldehyde resin. The tests were performed with Finn Chambers* on Scanpor* tape. Patches were removed and read after 2 and 4 days. Reactions were recorded according to the ICDRG scoring system. As shown in Table 1, the patient reacted only to the glue. No reaction was observed to the other tests. After cessation of work and referring to the physician dealing with occupational diseases, the patient underwent complementary allergic investigations, 1 month later. Prick testing with aeroallergens showed no positive reaction after 20 min. The adhesive manufacturers provided us with the formulation of each of the glues. A 2nd series of patch tests was carried out. It included various acrylates (Trolab* Hermal) and the offending glues (which were 99% ethyl cyanoacrylate). As shown
in Table 2, the patient reacted strongly to both adhesives (Bergman® and Cyanolit®) at very low concentrations. 30 normal controls had negative reactions when tested with the same glues (1% and 5% pet.).

These investigations revealed an undoubted occupational allergy to ethyl cyanoacrylate and led to the recognition of an occupational skin disease. The patient had to start a new job, and 10 months later she had experienced no recurrence.

**Discussion**

In our patient, whereas the fingers were only slightly affected, dermatitis concentrated on the eyelids. This may be due to their thinness and to rubbing with the fingers. Eyelids dermatitis is more often due to allergens applied elsewhere (4). In the present case, the “ectopic” dermatitis due to the cyanoacrylate glues resembled nail polish dermatitis.

A typical formulation of cyanoacrylate adhesives contains, according to Cronin (2), a cyanoacrylate, a plasticizer, a thickener which may be a methyl methacrylate polymer, and a stabilizer to inhibit polymerization. Fisher (3) gave the composition of one such glue: ethyl cyanoacrylate 90.6%, polymethyl methacrylate 9%, hydroquinone 0.4%, and organic sulphonic acid (traces). According to the manufacturers, DSA Bergmann® glue contains no solvent. Ethyl cyanoacrylate is the main constituent (≤99.9%); polymethyl methacrylate is the thickest and is a detail grade. Organic stabilizers are present in parts per million and consist of hydroquinone and an organic sulphonic acid. Cyanolit® glue is 99.6% ethyl cyanoacrylate; it contains no solvent and no thickener. Organic stabilizers are present at 0.4%, but hydroquinone is not present and therefore cannot be implicated. Moreover, in our case, hydroquinone, methyl methacrylate and possible acrylic contaminants showed no positive reaction. The positive patch tests (1% and 5% concentrations) to the glues, which are more than 99% ethyl cyanoacrylate, strongly suggest that ethyl cyanoacrylate was the offending allergen.

**Is ethyl cyanoacrylate a sensitizer?**

Calnan (1) and Fisher (3, 5) considered allergic reactions to products such as ethyl cyanoacrylate virtually impossible because of its immediate bonding to surface keratin. These authors have doubted whether this compound is capable of sufficient continuous absorption to induce an allergic contact dermatitis. The occurrence of irritation has not been questioned (3, 5). Calnan (1) reported an

![Fig. 2. Ethyl cyanoacrylate.](https://via.placeholder.com/150)
outbreak of irritant facial dermatitis from a cyanoacrylate glue among a group of electronic assembly workers due to low humidity. Concerning cyanoacrylate allergies, very little has been reported. In 1984, Shelley & Shelley (6) described a case of small plaque parapsoriasis which was found to be secondary to an ethyl cyanoacrylate allergy. In 1986, Pigatto et al. (7) reported a 14-year-old boy who had red, edematous, scaly lesions on and behind the ears. This young patient had been applying a cyanoacrylate adhesive in an attempt to correct his flappy ears. Patch tests were positive with the glue (10% pet.). Sertoli et al. (quoted by Pigatto et al. (7)) described 2 women in a lampshade factory with similar results. In 1987, Belsito (8) reported sensitization to an ethyl cyanoacrylate glue in 3 women who used it in nail wrapping processes. All 3 patients were positive to open and closed patches of the glue.

Including the present paper, at least 8 cases of allergy to ethyl cyanoacrylate have been described. Therefore, allergic reactions should not be considered impossible. Pigatto et al. (7) insisted on 2 important factors in the development of such dermatitis in their patient: the thinness of the horny layer of the ear and the repeated daily application. In our case, these 2 factors were also present: the acuteness on the eyelids and the daily occupational use of the glue.

To be a strong sensitizer, a molecule must fulfill at least 2 conditions: its physico-chemical properties should facilitate skin penetration and its intrinsic chemical reactivity toward nucleophilic residues of proteins should be high enough to allow the formation of covalent bonds. Paradoxically, if the chemical reactivity is too high, haptons can be trapped by keratinocytes and never reach immunocompetent structures. In that respect, lipophilic prohaptons can be considered as perfect agents. As they are chemically non-reactive, they can penetrate the skin easily, be metabolized in situ into very reactive structures and act as strong sensitizers. Due to the cyano group, cyanoacrylates (Fig. 2) can be considered as highly reactive molecules able to polymerize when they are in contact with traces of water. This reactivity makes unlikely, under normal conditions, the penetration of such molecules into the skin. Nevertheless, it seems that under special conditions of exposure, when the compound is applied for example on the eyelids where the skin is very thin (0.5 mm as compared to the integument of the face, measuring about 2 mm) and the mechanical protection very low, enough molecules may penetrate the skin to act as a strong sensitizer. On the back, positive patch tests with cyanoacrylates can be explained by the dilution of cyanoacrylate molecules in a non-reactive and hydrophobic medium such as petrolatum.

Considering the widespread use of "instant glues", contact dermatitis from ethyl cyanoacrylates seems to be extremely rare, but deserves continued consideration.

Acknowledgements
The author thank Bergmann GmbH & Co., Postfach 1154, 7958 Laupheim, Germany, and Eleco Produits, 126, bd Victor Hugo, 92110 Clichy, France, for their collaboration.

References

Address:
Roland R. Tomb
Clinique Dermatologique
Hôpital Civil I, Place de l' Hôpital
F-67091 Strasbourg
France