

Dentist's Occupational Allergic Contact Dermatitis Caused by Coconut Diethanolamide, N-ethyl-4-toluene Sulfonamide and 4-tolyldiethanolamine

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Dental personnel are exposed to many sensitizing compounds at work and often develop multiple delayed allergies. Here we report on a dentist who got sensitized to several products that have not, or only seldom, caused sensitization earlier. These products were: coconut diethanolamide from her handwashing liquids, N-ethyl-4-toluene sulfonamide, a resin carrier in dental materials for isolating cavities underneath restorations, and 4-tolyldiethanolamine, an accelerator for inducing polymerization of dental acrylic resins at room temperature. The patient also had allergic patch test reactions to formaldehyde, phenol-formaldehyde resin, fragrance mix, and lauryl monoethanolamide, possibly from occupational exposure. **Key words:** Dental personnel; Hand dermatitis; Acrylic resins; Occupational skin disease; Cosmetics; Handwashing liquid; Phenolformaldehyde resin; Formaldehyde; Fragrance mix; Lauryl ether monoethanolamide.

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Dental personnel often have multiple occupational allergies (1–3). Here we present a dentist who showed several unusual patch test reactions to her hand washing products and ingredients of acrylic resins.

CASE REPORT AND DISCUSSION

The patient was a 55-year-old dentist who as a child had had atopic dermatitis but not hand eczema. At the age of 53 she developed hand dermatitis at the base of fingers II–III on her right hand. She used this part of the hand to get hand washing liquid from a hygienic dosage device. She washed her hands more than twenty times a day and had mostly used three different hand washing liquids (Nonsid[®], Orion-yhtymä Oy, Espoo, Finland; Triosan[®], Leiras, Turku, Finland, and Sterisol[®], Suomen Sterisol Oy, Helsinki, Finland). They all contained coconut diethanolamide (Fig. 1). She had been working as a dentist for 30 years but had not used protective gloves before the dermatitis developed. She had also handled the dental composite resins without protective gloves in order to feel the right consistency of the hardening resin. She was exposed to acrylates both when handling dental composite resins and when remodelling acrylic dental devices. The dermatitis healed during the summer vacation but when back at work the patient relapsed. Eventually, nearly 2 years after the beginning of the hand dermatitis, she was remitted for more thorough investigations. When examined in our clinic she had

dermatitis on fingers II–III and paronychia of the third finger of the right hand.

Prick testing with twenty common environmental allergens, performed as previously described (4), gave no allergic reactions. Two patch test sessions were performed on the upper back with the Finn chamber method as previously described (1, 5, 6). She showed several allergic patch test reactions (Table I): to formaldehyde, fragrance mix, N-ethyl-4-toluene sulfonamide, 4-tolyldiethanolamine, phenol-formaldehyde resin, coconut diethanolamide and lauryl ether monoethanolamide (Fig. 1). The cosmetic series included cocamidopropyl betaine (CAPB, Chemotechnique Diagnostics, Malmö, Sweden, 1% aqua) but was negative. Amines and amides could cross-react but several amines gave a negative patch test reaction, namely: p-paraphenylene diamine (PPDA), several PPDA derivatives, ethylenediamine (standard series, rubber series; Chemotechnique), triethylene tetramine, diethylene triamine, diaminodiphenyl methane (plastics and glues-series; Chemotechnique), N-phenyl-beta-naphtyl amine (Chemotechnique) and N-phenyl-alfa-naphtyl amine (mixed by us),

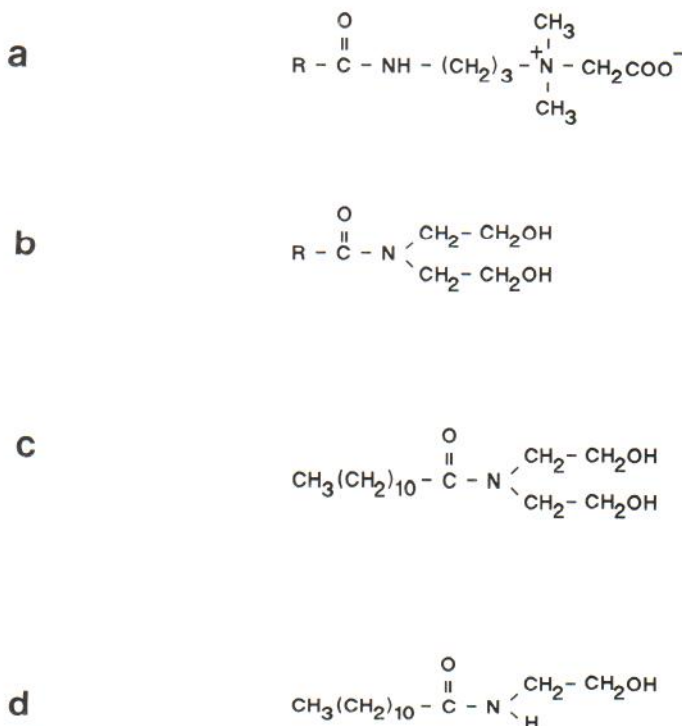


Fig. 1. Chemical structure of cocamidopropyl betaine (a), coconut diethanolamide (b), lauryl acid diethanolamide (c) and lauryl ether monoethanolamide (d). RCO-represents the coconut acid radical; R = C8–C18.

Table I. Dentist's allergic patch test reactions

	D2	D3	D6
Standard series			
Fragrance mix	2+	3+	3+
Formaldehyde	1+	2+	2+
Dental Screening			
N-ethyl-4-toluene sulfonamide	?+	+	2+
4-tolyldiethanolamine	2+	2+	3+
Plastics and glues series; Phenol-formaldehyde resin	–	2+	2+
Cosmetics; negative (includes cocamidopropyl betaine, 1% aqua)			
Fragrances: negative			
Antimicrobials: negative			
Rubber chemicals: negative			
“Own substances”			
Triosan® 10% (pet & aqua)	2+	2+	3+
Component: Comperlan KD 443/87 (= coconut diethanolamide): 1%, 3+; 0.32%, 2+; 0.1%, 2+; 0.032%, 1+; 0.01%: neg. (5 negative components)			
Nonsid® 10% (pet & aqua)	2+	2+	2+
Component: Coconut diethanolamide: 1%, 2+; 0.32%, 2+; 0.1%, 1+; 0.032%, neg. (5 negative components)			
Sterisol® (10% pet) (contains coconut diethanolamide)	?+	2+	3+
Other substances			
Lauryl ether monoethanolamide: 1%, 2+; 0.32%, 2+; 0.1%, 2+. (Aminol A 15, Chemy)			

triethanolamine stearate (Epikon OY, Helsinki, Finland, 3% pet) and triethanolamine (Chemotechnique, 2% pet) in the cosmetic series. Twenty controls gave a negative patch test reaction with lauryl ether monoethanolamide (1% pet). The dental screening series was negative except N-ethyl-4-toluenesulfonamide and 4-tolyldiethanolamine. Accordingly, all acrylates were negative, as were her own dental composite resins Concise A and B, and Silux Universal Opaque Paste (3M Company, MN, USA; 1% pet, see 1), indicating that she had not become sensitized to acrylates. She had often used Nobecutan spray (Astra, Meditec, Sweden) containing thiuram (1), but the rubber chemical series was negative.

On the first patch test session the patient had allergic patch test reactions to two of her own hand washing products: Triosan® and Nonsid®. The manufacturers kindly provided us with the components of these two hand washing liquids, and on subsequent patch testing the allergenic component, namely coconut diethanolamide (Table I), was revealed. CAPBs are surfactants frequently used in cosmetics. According to toxicological data (see 7–16), CAPB is safe and non-irritant, and it is therefore frequently used in shampoo, cleansing and deodorant formulations. Recently, however, CAPB has been shown to be an important sensitizer (7–17). CAPB was not present in our patient's products, and on patch testing CAPB also was negative. On the other hand, another coconut-derived product, coconut diethanolamide, which seldom has sensitized (18–20), gave a positive patch test reaction. The case reported by Nurse (18) had a positive patch test reaction when tested at 0.5% in pet (2+), while our patient in a dilution series was positive down to 0.1%. An earlier patient described by Van Haute & Dooms-Goossens (7) gave an allergic patch test reaction with both cocobetaine (= CAPB) and sodium lauryl

ether sulfate. Sodium lauryl ether sulfate was present in one of our patient's products, but on patch testing it gave a negative reaction. We used a slightly lower patch test concentration (0.7%, pet) than Van Haute & Dooms-Goossens (2%, aqua) (7), which could have influenced the patch test result. The manufacturer provided us with another component used in cosmetics, and present in coconut diethanolamide products, namely lauryl ether monoethanolamide (Fig. 1), which provoked allergic patch test reactions (Table I). We have not seen reports on allergic reactions caused by lauryl ether monoethanolamide but de Groot and coworkers (20) had a patient allergic to lauric acid diethanolamide (Fig. 1) from a shampoo. Our patient's allergic patch test reactions may represent cross-sensitivity between coconut diethanolamide and lauryl ether monoethanolamide (Fig. 1), or the allergen in coconut diethanolamide may have been lauryl ether monoethanolamide. Coconut diethanolamide and CAPB do not seem to cross-react (21).

The patient also had allergic patch test reactions to two components of the dental screening series: N-ethyl-4-toluene sulfonamide and 4-tolyldiethanolamine. Both components are included in the dental screening series because they are widely used in dentistry (3). Accordingly, it is apparent that our patient had been exposed to these chemicals at work, but cross-reactions between these dental amide/amine compounds and coconut diethanolamide and/or lauryl ether monoethanolamide cannot be excluded.

Acrylic resins are produced by inducing polymerization of a mixture of methyl methacrylate monomer and polymethyl methacrylate powder with benzoyl peroxide. The dough is hardened into shape by heating. At room temperature the reaction needs an accelerator (activator). The one most widely

used is the tertiary amine N,N-dimethyl-p-toluidine, which has caused some cases of allergic contact dermatitis (22–24). Another less active amine accelerator is 4-tolyldiethanolamine. Farli and coworkers (25) had a dental technician with positive patch test reactions to p-tolyldiethanolamine, but we have not come across any other reported cases.

N-ethyl-4-toluene sulfonamide is a resin carrier in dental materials used for isolating cavities underneath restorations. Chemotechnique has included it in its dental screening series. In a Swedish multicenter study, 9 out of 1657 patients with oral symptoms had an allergic patch test reaction to N-ethyl-4-toluene sulfonamide (unpublished). In a literature search we did not find any published cases of allergic contact dermatitis.

Dental personnel may be exposed to both phenol-formaldehyde resin (PFR) (26) and formaldehyde (3) at work. Our patient showed an allergic patch test reaction to both compounds (Table I). When tested with different PFRs, PFR of Chemotechnique (5% pet) and PFR-novolak (produced under acid conditions, see 27) of Hermal Chemie (Trolab, Reinbek, Germany, 5% pet) provoked 2+ allergic reactions, whereas PFR-resol of Trolab (produced under alkaline conditions, see 27) gave a negative reaction. This discrepancy in patch test results may be due to the heterogeneity of the PFR patch test substances, which include several allergens (27). Beck's experience (28) was that neither PFR-novolak nor PFR-resol of Trolab is suitable for tracing PFR allergy. PFR-novolaks are considered rare allergens (29). Nevertheless, during 40 months we patch-tested 149 patients, and found 4 who got allergic patch test reactions from PFR of Chemotechnique and PFR-novolak of Trolab; no allergic reactions caused by PFR-resol of Trolab were detected. The best way to detect PFR allergy is still to patch-test with the patient's own resins (27, 28). Our patient had a concomitant sensitization or cross-allergy to formaldehyde (a dilution series provoked the following patch test reactions: 2%, 3+; 1%, 2+; 0.32%, 2+; 0.1%, 1+). PFR allergic patients are usually not allergic to formaldehyde (27). On the other hand, our patient did not have positive reactions to p-tert.-butylphenol formaldehyde resin (PTBT-F-R), although PTBT-F-R allergic reactions are more common than formaldehyde reactions in PFR allergic patients (27). 2-monomethylol phenol (2-MP), an intermediate in the production of PFR, may remain in PFR and provoke allergy (27). 2-MP is used in our plastics and glues series (1%, pet, Chemotechnique, see 30) but gave a negative patch test reaction. Our patient's allergic patch test reactions to PFR were confirmed during the second patch test session, which yielded identical results. An allergic PFR patch test reaction may also be a cross-reaction between PFR and fragrance mix; both contain phenols (27). Recently we reported on 3 patients allergic to PFR in rock wool; they all also had an allergic patch test reaction to fragrance mix (31). Fragrance mix may be not only the mixture of eight different fragrances, but new haptens may develop when such a mixture is made. In favour of this speaks our patient's reactions to the individual fragrances; they were all negative (Table I).

The patient had several allergic patch test reactions, and two patch test sessions were performed. Some authors believe that a single strong allergic patch test reaction may excite the skin

to become hyper-reactive, and accordingly concomitant false-positive reactions would develop (32). From a practical point of view it is usually not possible to patch-test a patient showing multiple allergic reactions with patch test sessions for each individual allergen. Furthermore, more recent evidence indicates that an allergic patch test reaction does not induce false-positive patch test reactions (33, 34). It has even been suggested that single allergen patch testing by itself is inadequate (35). The patch test reactions of our patient were in accordance with those generally accepted as allergic.

Our patient stopped using products containing coconut diethanolamide, started using protective gloves, and her hand dermatitis has been well.

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