SHORT COMMUNICATION

Patch Testing with Isobornyl Acrylate in 16 Swedish Patients with Contact Dermatitis from Glucose Sensors and/or Insulin Pumps

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Medical devices for insulin infusion and monitoring of blood glucose levels have been reported to cause severe contact allergic reactions in diabetic patients. Isobornyl acrylate (IBOA) has been identified as a sensitizer in both the FreeStyle® Libre glucose sensor (Abbott Diabetes Care, Witney, Oxfordshire, UK) (1) and the OmniPod® insulin pump (Insulet Corporation, Billerica, MA, USA) (2) by chemical investigations performed at the Department of Occupational and Environmental Dermatology, Malmö, Sweden. In this report we present the results from patch testing with IBOA in 4 Swedish dermatology clinics.

METHODS AND RESULTS

Between May 2017 and February 2018, 16 patients suffering from diabetes mellitus type 1 were referred to the participating centres due to suspected contact allergic reactions to glucose sensors and/or insulin pumps. Cases 1–4 were seen in Uppsala, case 5 in Uddevalla, case 6 in Örebro and cases 7–16 in Malmö. Six of the patients were children (age 6–13 years) and 10 were adults (age 19–53 years). Patch test preparations of IBOA (Sigma-Aldrich, Steinheim, Germany) were prepared in petrolatum (Vaselin Vitt, APL, Stockholm, Sweden) at the Department of Occupational and Environmental Dermatology, Malmö, and were then distributed to the other centres. All patients were patch-tested with IBOA at 0.1% and 0.01% (w/w) in petrolatum. Thirteen of the patients were also patch-tested with the Swedish baseline series. Six of the patients were tested with parts from the glucose sensors and/or insulin pumps either *as is* or as extracts (**Table I**).

Information on the patients, including the devices causing dermatitis and patch test results is presented in Table I. The majority of the patients (12 of 16) had a history of skin reactions to FreeStyle Libre, while 7 had a history of skin reactions to OmniPod. Eleven patients had a positive reaction to 0.1% IBOA and of these 4 were also positive to 0.01% IBOA. In the patients with skin reactions to FreeStyle Libre, 10 of 12 were positive to IBOA. In the patients with skin reactions to OmniPod 4 of 7 were positive to IBOA and one had a doubtful reaction.

DISCUSSION

High frequencies of skin reactions have been reported in patients using glucose sensors and/or insulin pumps (3, 4). Initially irritant reactions were suspected (5) but later IBOA was identified as a culprit allergen in FreeStyle Libre and OmniPod (1, 2). Furthermore, *N,N*-dimethylacrylamide has been identified as a sensitizer in FreeStyle Libre (6). There are also reports on contact allergic reactions to 2-ethyl cyanoacrylate (ECA) in the Dexcom G4 Platinum® sensor (Dexcom, Inc, SanDiego, CA, USA) (7–9), but ECA is no longer used in these sensors (10). Colophony has been reported to be contained both in OmniPod and in Enlite glucose sensors (Medtronic Minimed, Northridge, CA, USA) (11).

The majority of our patients with reactions to FreeStyle Libre and/or OmniPod were allergic to IBOA. In these patients, the onset of dermatitis after the first use of the first product, giving skin reactions, ranged from 1 to 24 months. Once a reaction had occurred, new reactions to the devices developed within a few days, which suggests that the patients have been sensitized to IBOA when using the glucose sensor/insulin pumps. Some patients have reacted to more than one medical device. For example case 14 developed reactions to OmniPod after using the pump for 2 years and then reacted to FreeStyle Libre after 3 days the first time it was used.

As we have not been able to get any detailed information regarding the composition of materials used in the devices from the manufacturers, chemical investigations have been necessary to identify allergens causing skin reactions. The lack of information also makes it difficult to give advice on possible alternatives for the sensitized individuals. However, recently glucose sensors from Dexcom have been suggested as an IBOA free alternative for patients sensitized to IBOA (12).

Some patients have been able to continue using their sensors despite their contact allergies by using barrier creams, patches and sprays between the skin and the sensor (6, 13). However, the use of barrier materials under FreeStyle Libre sensors has been advised against as it may affect the performance of the device (14). Freestyle Libre sensors with a revised formulation of the adhesive will be available to UK customers from April 2019 (14). Whether this leads to fewer patients being sensitized and whether already sensitized patients will be able to use the new sensors remains to be seen.

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Table I. Patch test results and information on the medical devices causing dermatitis in 16 patients

Case	Age (years)	Sex	Device causing dermatitis	Onset of dermatitis after first use (months)	Onset of dermatitis after renewed exposure (days)	Patch test results				
						Sensor/pump	IBOA 0.1% pet	IBOA 0.01% pet	Baseline series	Additional test series/ preparations
1	45	M	OP FL	18–24 18–24	3–7 3	NT	++	–	NT	NT
2	10	M	OP DG4	1–2 1	3 3–5	OP patch as is ?+ OP patch acetone extract + DG4 patch as is + DG4 patch acetone extract ?+	?+	–	MP + paraben mix +	Tegaderm 3M – Tegaderm 3M –
3	19	F	OP	1	1–2	OP patch as is – OP patch acetone extract –	++	+	SLM ++	NT
4	6	M	OP DG5	1 1	3–7 3–7	DG5 patch as is – DG5 patch acetone extract – OP patch as is – OP patch extract –	–	–	NT	NT
5	13	M	DG4 FL Enlite	3–4 2 2	<7 <7 <7	DG4 as is papules FL (whole) as is ++	++	?+	FM I + SLM +	ECA ++
6	43	F	FL	24	<3	FL patch as is – FL patch ethanol extract –	+	?+	$NiSO_4$ ++	NT
7	53	M	FL	6	<7	NT	+	–	–	(meth)acrylate series – DMAA – ECA –
8	41	F	FL	<1	<7	NT	–	–	–	DMAA –
9	10	M	FL OP	4–6 0	<7 3	NT	+	–	SLM ?+	costunolide ++ DMAA –
10	34	F	FL	2–6	<7	NT	+	–	–	DMAA – ECA – HEA ?+
11	54	F	FL	2–6	<7	NT	–	–	–	DMAA –
12	7	F	OP	U	<3	NT	–	–	colophony +	ox. linalool + ox. limonene +
13	28	F	FL	4	<7	NT	+++	+++	MP ++	DMAA +++
14	48	F	OP FL	24 0	1 1	NT	+++	+++	SLM +++	NT
15	11	F	FL	2	<7	FL patch acetone extract ++ FL sensor acetone extract ++	++	+	SLM +	costunolide + ox. limonene + DMAA ++
16	36	F	FL	12	1	NT	++	NT	FM II ++	farnesol + GSTS +

The strongest reactions on either day 3 or 4 and on day 7 is presented.
OP: OmniPod; FL: FreeStyle Libre; DG4: Dexom Platinum G4; DG5: Dexcom Platinum G5; NT: not tested; DMAA: *N,N*-dimethylacrylamide; ECA: 2-ethylcyanoacrylate; FM I: fragrance mix I; FM II: fragrance mix II; GSTS: gold sodiumthiosulfate; HEA: hydroxyethylacrylate; MP: Myroxilon pereirae; $NiSO_4$: nickelsulfate hexahydrate; SLM: sesquiterpenelactone mix.

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