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Recommendation to include hydroxyethyl (meth)acrylate in the British Baseline Patch Test Series

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What is already known about this topic?

- A significant rate of sensitisation to (meth)acrylates has been demonstrated worldwide.
- Increasing demand for acrylic nail fashion is putting consumers and nail technicians at risk of sensitisation to (meth)acrylates.

What does this study add?

- Inclusion of 2-hydroxyethyl methacrylate (2-HEMA) 2% pet. in the baseline series detects treatable (meth)acrylate allergic contact dermatitis (ACD).
- Identifying (meth)acrylate ACD is important as it can have adverse health consequences for patients who require composite fillings, surgical glue and bone cement, all of which contain (meth)acrylates.
- We recommend that 2-HEMA 2% pet. be added to the British baseline patch test series, and to baseline series used in other countries.

Key words

2-hydroxyethyl methacrylate; (meth)acrylates; allergic contact dermatitis

Summary

Background (Meth)acrylates are potent sensitisers and a common cause of allergic contact dermatitis (ACD). The frequency of (meth)acrylate ACD has increased with soaring demand for acrylic nails. A preliminary audit has suggested a significant rate of positive patch tests to (meth)acrylates using aimed testing in patients providing a clear history of exposure. (Meth)acrylates have to date not been routinely tested in the baseline patch test series in the U.K. and Europe.

Objectives To determine whether inclusion of 2-hydroxyethyl methacrylate (2-HEMA) 2% in petrolatum (pet.) in the baseline series detects cases of treatable (meth)acrylate ACD.

Methods During 2016-2017, 15 U.K. dermatology centres included 2-HEMA in the extended baseline patch test series. Patients with a history of (meth)acrylate exposure, or who tested positive to 2-HEMA, were selectively tested with a short series of eight (meth)acrylate allergens.

Results 5,920 patients were consecutively patch tested with the baseline series, of whom 669 were also tested to the (meth)acrylate series. 102 of 5,920 (1.7%) tested positive to 2-HEMA and 140 (2.4%) to at least one (meth)acrylate. Had 2-HEMA been excluded from the baseline series, (meth)acrylate allergy would have been missed in 36 of 5,920 (0.6% of all

patients). The top (meth)acrylates eliciting a positive reaction were 2-HEMA (n=102; 1.7%), 2-hydroxypropyl methacrylate (n=61; 1%) and 2-hydroxyethyl acrylate (n=57; 1%).

Conclusions We recommend that 2-HEMA 2% pet. be added to the British baseline patch test series. We also suggest a standardised short (meth)acrylate series which is likely to detect most cases of (meth)acrylate allergy.

Introduction

Acrylates and methacrylates are monomers which polymerise to make acrylic plastics. Their use is widespread including in orthopaedic surgery, dentistry and the printing and beauty industries. (Meth)acrylates are potent sensitisers and are a common cause of ACD.

The frequency of (meth)acrylate allergy has increased in recent years with a shift in occupational and recreational exposure towards the beauty industry.[1-3] There is soaring demand for longer lasting nail fashion compared with traditional varnish. Acrylic, sculpted, gel, and gel polish nails such as Shellac® (a popular brand of gel polish in the U.K.) all contain (meth)acrylates, and nail glue contains cyanoacrylates. There are numerous stages during the application process whereby beauticians in nail bars and their clients are at risk of becoming sensitised.

In the U.K., the rate of (meth)acrylate allergy in Leeds tripled from 2008 to 2014.[2] In Birmingham, U.K., there was a shift in exposure from industrial sources towards acrylic nails between 2002 and 2015.[4] The Health and Occupation Research Network found that (meth)acrylates were the most frequently cited source of ACD in beauticians between 1999 and 2011.[3] A similar pattern has been observed internationally. In Portugal, from 2006 to 2013, nail (meth)acrylates were responsible for 76% of (meth)acrylate-related ACD,[5] and this pattern has been replicated in international studies.[6,7] (Meth)acrylates were named Contact Allergen of the Year by the American Contact Dermatitis Society in 2012 and were included in their baseline series in 2017.[8] Methyl methacrylate has been banned in nail cosmetics in some states in the USA.

To date, (meth)acrylates have not been routinely included in the baseline patch test series in the U.K. and in Europe. Our preliminary retrospective audit in 9 U.K. dermatology centres between 2008 and 2015, using selective patch testing to acrylates based on a clear history of exposure, found the frequency of sensitisation to any (meth)acrylate to be a minimum of 1.3%; and to 2-HEMA, the most commonly sensitising (meth)acrylate, to be

0.7%.[9] The European Society of Contact Dermatitis (ESCD) suggests that an allergen might be included in the baseline series when the proportion of consecutively patch tested patients with a positive test to a specific allergen exceeds 0.5-1.0%.[10] As 0.7% was likely to be an underestimate, we set up a further prospective audit, including 2-HEMA in the extended baseline patch test series. We aimed to identify cases of (meth)acrylate ACD which would otherwise have been missed and to identify the most common (meth)acrylate allergens to test positive, with the intention of recommending a shortened (meth)acrylate series for testing in the U.K.

Method

During a 12-month period between December 2016 and November 2017, data were collected from 15 U.K. and Irish dermatology departments (Bath, Birmingham, Cardiff, Cork, Dundee, East Kent, Imperial College London, Leeds, Leicester, Newport, Oxford, Portsmouth, The Royal Free Hospital London, Sheffield, South Tees). A total of 5,920 consecutive patients with eczema referred to a dermatology clinic for patch testing were tested to the extended British baseline patch test series including 2-HEMA 2% pet. Patients with a history of (meth)acrylate exposure, for example those working in the dental, printing, or nail and beauty industries, were selectively tested with a short series of eight (meth)acrylate allergens. Those who tested positive to 2-HEMA at the day 2 reading had the series of 8 (meth)acrylates added on day 2.

The eight (meth)acrylate allergens tested in the short series were: 2-hydroxypropyl methacrylate (2-HPMA); ethyl acrylate (EA); ethylene glycol dimethacrylate (EGDMA); tetraethylene glycol dimethacrylate (TEGDMA); 2-hydroxyethyl acrylate (2-HEA); 1,6-hexanediol diacrylate (1,6 HDDA); ethyl cyanoacrylate (ECA) and triethylene glycol diacrylate (TREGDA).

Allergens were obtained from Chemotechnique Diagnostics (Vellinge, Sweden). All departments used the same test material. The allergens were stored and dispensed according to the manufacturer's instructions. (Meth)acrylate allergens were transported in airtight tubes and prepared immediately prior to application by experienced patch test nurses, to reduce any evaporation of the volatile (meth)acrylate compounds which could lead to a falsely low rate of reactions. The amount of allergen applied was enough to fill the well of the disc but not extrude when the patch was applied to the patients back. Patches were applied for 48 hours under occlusion.

Readings were carried out according to ESCD guidelines on day 2 and day 4 by dermatologists experienced in interpreting patch tests.[10] Patients who had the short (meth)acrylate series added at day 2 were either asked to return for a day 7 reading, or to contact their patch test centre for a further reading if any new patch test sites became positive. Allergic patch test reactions were scored according to International Contact Dermatitis Research Group criteria.[10]

We recorded which patients had the short (meth)acrylate series added at day 2, after a positive screening test to 2-HEMA, to distinguish them from those predicted to have (meth)acrylate allergy by history, who had the short series added at day 0. Some units tested to other (meth)acrylate allergens, not included in the series of eight, and any reactions were recorded. Demographic details recorded were age, sex, occupation, history of atopy and history of use of nail products (in particular those known to the U.K. consumer as Shellac® (gel polish), gel nails, nail products requiring curing by ultraviolet (UV) light, or nail glues). The primary site of dermatitis was recorded, or where multiple sites were involved, such as 'hands and feet', this was documented.

Results

A total of 5,920 consecutive eczema patients were patch tested to the extended baseline series, including 2-HEMA, at 15 U.K. centres (Table 1). Of these, 669 selected patients with a history of (meth)acrylate exposure (n=633), or who tested positive to 2-HEMA in the baseline series (n=36), were tested to the short (meth)acrylate series. 140 patients tested positive to at least one (meth)acrylate allergen with a total of 416 positive reactions. 102 patients tested positive to 2-HEMA.

Of the 140 patients with proven (meth)acrylate ACD, 104 had the (meth)acrylate series added at day 0, as they had a clear history of (meth)acrylate exposure. Thirty-six patients who had provided no history of (meth)acrylate exposure had the series added at day 2, following a positive reaction to 2-HEMA in the baseline series. In these 36 patients a diagnosis of (meth)acrylate ACD would have been missed, had 2-HEMA not been included in the baseline series.

The top (meth)acrylates eliciting a positive reaction were 2-HEMA (n=102; 1.7%), 2-HPMA (n=61; 1% minimum predicted value if tested in all patients) and 2-HEA (n=57; 1% minimum predicted value if tested in all patients) (Table 2). Irritant reactions were recorded in two patients, one to both 2-HEMA and EGDMA and the other to 2-HEMA.

Thirty-four patients with (meth)acrylate ACD did not test positive to 2-HEMA in the baseline patch test series, but had been suspected to have (meth)acrylate allergy based on their history. Of the allergens included in our short (meth)acrylate series, ECA recorded the highest number of positive reactions (n=16), in these patients.

Positive reactions to (meth)acrylates not included in our short (meth)acrylate series were as follows: diethyleneglycol diacrylate (DEGDA) 0.1% pet. in 23 patients; methyl methacrylate (MMA) 2% pet. in 16 patients and ethyl methacrylate (EMA) 2% pet. in 11 patients. Four patients tested positive exclusively to DEGDA. DEGDA, MMA and EMA were not tested in all patients with suspected (meth)acrylate allergy, so no data on the comparative frequency of sensitisation were available.

A striking female predominance was noted in patients with (meth)acrylate ACD. 94% (n=131) of all 140 patients with positive reactions to (meth)acrylates were female and 6% (n=9) were male. The mean age was 41.2 years, median 38 and range 15 to 73. 56 patients (40%) were atopic. The mean duration of dermatitis was 24 months, median 24 and range 2 to 216. Hands were the most common primary site of dermatitis in 68 patients (49%), followed by the face in 25 patients (18%) (Fig 1). Many patients had more than one site affected.

Of the 140 patients with proven (meth)acrylate ACD, 76 (54%) stated that they had been exposed to (meth)acrylates in UV-cured nails; 71 (53%) in gel nails; 51 (35%) in Shellac® (gel polish nails), 26 (19%) in nail glue; 10 (7%) in dentistry; 4 (3%) in orthopaedics and 1 (1%) in the printing industry (Fig 2). Many patients had been exposed to (meth)acrylates in multiple nail products; a minority had also had exposure from other sources such as dental procedures.

Of the 140 patients with proven (meth)acrylate ACD, occupational exposure was recorded in 38 (27%). Apart from one patient who was a printer, all patients with occupational exposure worked in the nail and beauty industry and in addition all of these used acrylic nails recreationally. Non-occupational exposure alone, due to professional application of cosmetic nails containing (meth)acrylates, was recorded in 97 (69%) patients, 3 of whom also used home gel nail kits. The remaining five patients had other non-occupational sources of exposure, 3 from surgical glue and 2 from medical dressings; one a stoma adhesive device and one a transcutaneous electrical nerve stimulation adhesive device. There were no patients for whom the source of exposure was unidentified.

Discussion

This large multicentre prospective audit has confirmed that the proportion of consecutively patch tested patients in the U.K. with a positive test to 2-HEMA is 1.7%, well above the ESCD recommended threshold of 0.5-1.0% for inclusion in a baseline patch test series.[10] We have shown an increase in the number of cases of (meth)acrylate ACD identified when 2-HEMA is included in the baseline series, rather than relying on history alone. We would have missed almost one third of cases of (meth)acrylate ACD had 2-HEMA not been incorporated in the baseline series. It is important not to miss (meth)acrylate allergy, to avoid cases of recalcitrant undiagnosed cosmetic allergy.

2-HEMA's ability to detect most cases of (meth)acrylate ACD is widely recognised. As we anticipated, 2-HEMA was the most frequent (meth)acrylate allergen to test positive. Although a number of other (meth)acrylates were positive in many patients due to coupled reactivity, most, (73%; n=102 of the 140 cases) would have been identified as having (meth)acrylate allergy by using 2-HEMA alone as a screening agent. The short (meth)acrylate series tested in this audit included the most common (meth)acrylate allergens to test positive.

There were four patients who reacted exclusively to DEGDA. A diagnosis of DEGDA ACD would have been missed in these patients, despite screening with 2-HEMA and testing to the short series of 8 (meth)acrylate allergens. Additionally, isobornyl acrylate has been recently reported to cause ACD in indwelling glucose monitors, a (meth)acrylate not present in routinely commercially available (meth)acrylate allergen series.[11-13] Hence, we feel that supplemental (meth)acrylate allergens should be added to the shortened series to avoid missing relevant allergy. We suggest adding the following 6: DEGDA, 1,4 butanediol dimethacrylate (1,4 BDMA), EMA, MMA, triethylene glycol dimethacrylate (TREGDMA) and tetrahydrofurfuryl methacrylate (THFMA) (Table 3). The addition of these 6 extra allergens is based on the results of our audit and a literature review of recently published studies demonstrating the most frequent (meth)acrylates to cause allergy in Europe.[1,5,6,7,14,16] Once isobornyl acrylate becomes commercially available as a patch test allergen, we plan to add this to our recommended series of 14.

Routinely testing 2-HEMA and adding a shortened (meth)acrylate series, if the history indicated, would detect most cases of ACD to (meth)acrylates. Testing to a shortened (meth)acrylate series would avoid some patch test-associated morbidity due to coupled reactivity giving multiple strongly positive reactions**.** Commercial patch test allergen providers supply multiple (meth)acrylate series for testing, depending on the likely source of

(meth)acrylate exposure, some of which have up to 24 (meth)acrylate allergens. We feel that it is simpler to have one series to cover all types of (meth)acrylate exposure.

Coupled reactivity amongst the acrylate class is well documented[5,14-17] and is reflected in our patient population where 416 positive reactions were recorded in 140 patients. Acrylic nail products contain a number of different acrylic allergens which can cause concomitant sensitisation and therefore it is difficult to elicit the exact allergen to which an individual is sensitised. Some allergens are more likely to show coupled reactivity than others, in particular 2-HEMA, which again supports its use as a screening allergen.

ACD to cyanoacrylates occurs less frequently than that to (meth)acrylates. Cyanoacrylates, used as nail, eyelash, surgical and instant glue (such as ethyl cyanoacrylate (Superglue®) and 2-octyl cyanoacrylate (Dermabond®)), do not usually show concomitant sensitisation to (meth)acrylates including 2-HEMA. Ten of our patients with (meth)acrylate ACD (9%) reacted to ECA alone, and were not detected by testing to 2-HEMA. Although we cannot rely on 2-HEMA to detect allergy to cyanoacrylates, the history of cyanoacrylate ACD is often more obvious, with the patient observing that the use of glue led to a localised cutaneous reaction, such as a reaction following application of false eyelashes, or one localised to a surgical wound.[18] The combination of a thorough history, and the addition of 2-HEMA alone as a screening allergen, should detect most cases of (meth)acrylate allergy, including those sensitised to cyanoacrylate, who would have the short methacrylate series added based on a clear history of a glue reaction.

The authors recognise that (meth)acrylates are potent sensitisers and as such patch test sensitisation may occur. This has been largely attributed to the higher concentrations at which (meth)acrylates were historically tested.[19-21] Since the use of lower patch test concentrations, the problem of patch test sensitisation has diminished. None of the recent references in our selective literature review, covering the last two decades, report any cases of active sensitisation. (Meth)acrylates sometimes cause irritant reactions which can be difficult to distinguish from true positive results. As experienced clinicians interpreted results in all our participating units, and as ESCD guidelines were followed in the reading and interpretation of positive patch test results, we believe that misinterpretation of patch test findings was kept to a minimum.[10]

There are numerous points during the application of acrylic nails whereby a consumer is at risk of sensitisation: pushing back the cuticle and nail fold which can breach the epidermal barrier; soaking nails in highly irritant acetone to aid removal; and inadequately polymerising

acrylic monomers under the incorrect wavelength of UV light. Those working in the nail and beauty industry may additionally be using no gloves, or gloves that (meth)acrylates can penetrate, and may be exposed to airborne (meth)acrylate allergen while filing nails, in some cases causing respiratory symptoms. Soaring demand for acrylic nails, which are durable and perceived as aesthetically pleasing, has led to nail bars being ubiquitous on every high street. Two-thirds of our patients with (meth)acrylate ACD were sensitised by cosmetic use of acrylic nails and almost one third via their occupation in the nail and beauty industry. Nail technicians are often young, inadequately trained, and working in poor, sometimes slave-like conditions, as highlighted in recent media reports.[22,23] It is unlikely that these establishments are adequately training nail technicians to protect themselves from the risks mentioned above. Additionally, there is an identified increase in consumers buying easily accessible home nail kits, which may have the incorrect wavelength of UV light.[24,25,26]

In the European Union, the Scientific Committee on Consumer Safety (SCCS) provides opinions concerning health and safety risks of non-food consumer products. Surprisingly, the SCCS stated that 2-HEMA is unlikely to pose a risk of sensitisation when applied *appropriately* to the nail plate at concentrations up to 35% - supporting this by stating that the normal nail plate acts as a good barrier to the penetration of chemical substances and that 2-HEMA polymerises rapidly under UV-curing, leaving little chance for monomers to be absorbed.[27] It determined that any risk of sensitisation is posed by *inappropriate* application by a consumer, or constant exposure in a nail technician. In the USA, some states ban the use of MMA in cosmetics and there is some public awareness of acrylate allergy.[28-30] The epidemic of allergy to (meth)acrylates, if not controlled, could mirror the recent epidemic of allergy to the preservative methylisothiazolinone. It is our role as dermatologists to raise the alarm.[31, 32]

In July 2018, the BSCA added 2-HEMA to the British baseline series. Recently there has been a decision to add 2-HEMA to the European baseline series[33,34] and the ESCD recommends routinely screening with 2-HEMA from January 2019.[35]

Conclusion

We have conclusively demonstrated that (meth)acrylate ACD is being missed in the U.K. and Ireland. The BSCA have recently updated their guidance by including 2-HEMA in the British baseline series. These data clearly show that testing 2-HEMA in the baseline patch test series will help to identify treatable disease, avoid further morbidity, and provide evidence to regulators that preventable cosmetic and occupational allergy is occurring.

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			2-HEMA			2-HPMA			EA			EGDMA			TEGDMA			HEA			1,6 HDDA			ECA			TREGDA			Total No. of positive (+/++/+++) to any (meth)acrylate
	Total No. of patients patch tested to baseline series	Total No. of patients patch tested to short (meth)acrylate series	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	IR	?+	+/++/+++	
Bath	170	45	0	1	5	0	1	5	0	0	2	0	2	4	0	0	3	0	0	2	0	0	0	0	1	1	0	0	1	23
Birmingham	465	109	0	1	6	0	1	3	0	1	5	0	0	4	0	0	0	0	1	5	0	1	3	0	0	1	0	0	2	29
Cardiff	241	12	0	0	3	0	0	2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	7
Cork	182	21	0	0	5	0	0	4	0	0	6	0	0	4	0	0	2	0	1	5	0	0	2	0	0	0	0	0	1	29
Dundee	420	31	0	0	7	0	0	4	0	0	4	0	0	4	0	0	1	0	0	6	0	0	0	0	0	1	0	0	0	27
East Kent	441	90	0	0	9	0	0	7	0	1	4	0	0	6	0	1	5	0	0	5	0	0	2	0	0	2	0	1	2	42
Imperial	328	3	0	0	3	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	8
Leeds	898	144	0	0	10	0	0	6	0	0	4	0	0	5	0	0	5	0	0	4	0	0	4	0	0	5	0	0	2	45
Leicester	134	6	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Newport	635	68	0	1	9	0	0	6	0	1	5	0	1	5	0	0	5	0	1	4	0	1	4	0	0	3	0	1	3	44
Oxford	541	31	0	0	12	0	0	4	0	0	3	0	0	4	0	0	3	0	0	4	0	0	2	0	0	1	0	0	2	35
Portsmouth	186	9	1	0	6	0	0	2	0	0	2	0	0	2	0	0	0	0	0	2	0	0	1	0	0	1	0	0	0	16
Royal Free Hospital	575	15	0	0	8	0	0	5	0	0	5	0	0	5	0	0	3	0	0	7	0	0	0	0	1	3	0	0	1	37
Sheffield	448	51	1	0	6	0	1	1	0	2	1	1	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0	0	10
South Tees	256	34	0	0	13	0	0	11	0	1	9	0	1	6	0	1	5	0	0	10	0	1	4	0	0	3	0	1	3	64
TOTAL	**5920**	**669**	**2**	**4**	**102**	**0**	**4**	**61**	**0**	**6**	**51**	**1**	**6**	**50**	**0**	**3**	**32**	**0**	**4**	**57**	**0**	**3**	**22**	**0**	**3**	**24**	**0**	**3**	**17**	**416**

Table 1. Total number of patients patch tested to baseline and short (meth)acrylate series at each centre, and the number of irritant (IR), doubtful (?+) and positive reactions to 2-HEMA and to the 8 allergens in the short (meth)acrylate series. 2-hydroxyethyl methacrylate (2-HEMA); 2-hydroxypropyl methacrylate (2-HPMA); Ethyl acrylate (EA); Ethylene glycol dimethacrylate (EGDMA); Tetraethylene glycol dimethacrylate (TEGDMA); 2-hydroxyethyl acrylate (2-HEA); 1,6-Hexanediol diacrylate (1,6 HDDA); Ethyl cyanoacrylate (ECA); Triethylene glycol diacrylate (TREGDA).

(Meth)acrylate allergen (listed in order of most common allergen to test positive)	No. of patients who tested positive to each (meth)acrylate allergen	% of patients who tested positive to each (meth)acrylate allergen, of the 669 selected patients tested to the short (meth)acrylate series	% of patients who tested positive, of the total patch test population tested to the extended baseline series (n=5920)
2-HEMA 2% pet	102	N/A	1.7
2-HPMA 2% pet	61	9.1	1.0
2-HEA 0.1% pet	57	8.5	1.0
EA 0.1% pet	51	7.6	0.9
EGDMA 2% pet	50	7.5	0.8
TEGDMA 2% pet	32	4.8	0.5
ECA 10% pet	24	3.6	0.4
1,6 HDDA 0.1% pet	22	3.3	0.4
TREGDA 0.1% pet	17	2.5	0.3

Table 2. Number of patients who patch tested positive to each (meth)acrylate allergen; % rate of allergy in 669 selected patients patch tested to the short (meth)acrylate series; predicted minimum % rate of allergy if tested in the baseline series in unselected patients (n=5,920). 2-hydroxyethyl methacrylate (2-HEMA); 2-hydroxypropyl methacrylate (2-HPMA); Ethyl acrylate (EA); Ethylene glycol dimethacrylate (EGDMA); Tetraethylene glycol dimethacrylate (TEGDMA); 2-hydroxyethyl acrylate (2-HEA); 1,6-Hexanediol diacrylate (1,6 HDDA); Ethyl cyanoacrylate (ECA); Triethylene glycol diacrylate (TREGDA).

(Meth)acrylate allergens recommended in BSCA short series	
1,4 Butanediol dimethacrylate (1,4 BDMA) 2% pet (CAS number 2082-81-7)	Ethyl acrylate (EA) 0.1% pet * (CAS number 140-88-5)
Ethyl cyanoacrylate (ECA) 10% pet * (CAS number 7085-85-0)	Ethyl methacrylate (EMA) 2% pet (CAS number 97-63-2)
Ethylene glycol dimethacrylate (EGDMA) 2% pet * (CAS number 97-90-5)	Diethylene glycol diacrylate (DEGDA) 0.1% pet (CAS number 4074-88-8)
1,6-hexanediol diacrylate (1,6 HDDA) 0.1% pet * (CAS number 13048-33-4)	2-hydroxyethyl acrylate (2-HEA) 0.1% pet * (CAS number 818-61-1)
2-hydroxypropyl methacrylate (2-HPMA) 2% pet * (CAS number 27813-02-1)	Methyl methacrylate (MMA) 2% pet (CAS number 80-62-6)
Triethylene glycol diacrylate (TREGDA) 0.1% pet * (CAS number 1680-21-3)	Tetraethylene glycol dimethacrylate (TEGDMA) 2% pet * (CAS number 109-17-1)
Tetrahydrofurfuryl methacrylate (THFMA) 2% pet (CAS number 2455-24-5)	Triethylene glycol dimethacrylate (TREGDMA) 2% pet (CAS number 109-16-0)

Table 3. Recommended British Society of Cutaneous Allergy (BSCA) short series of 14 (meth)acrylates (we recommend supplementing this list with isobornyl acrylate when it becomes commercially available as a patch test allergen). * Eight allergens included in the short (meth)acrylate series, which were tested from Day 0 in patients whose history suggested (meth)acrylate allergy and from Day 2 in patients with a positive test to 2-hydroxyethyl methacrylate (2-HEMA) at Day 2.

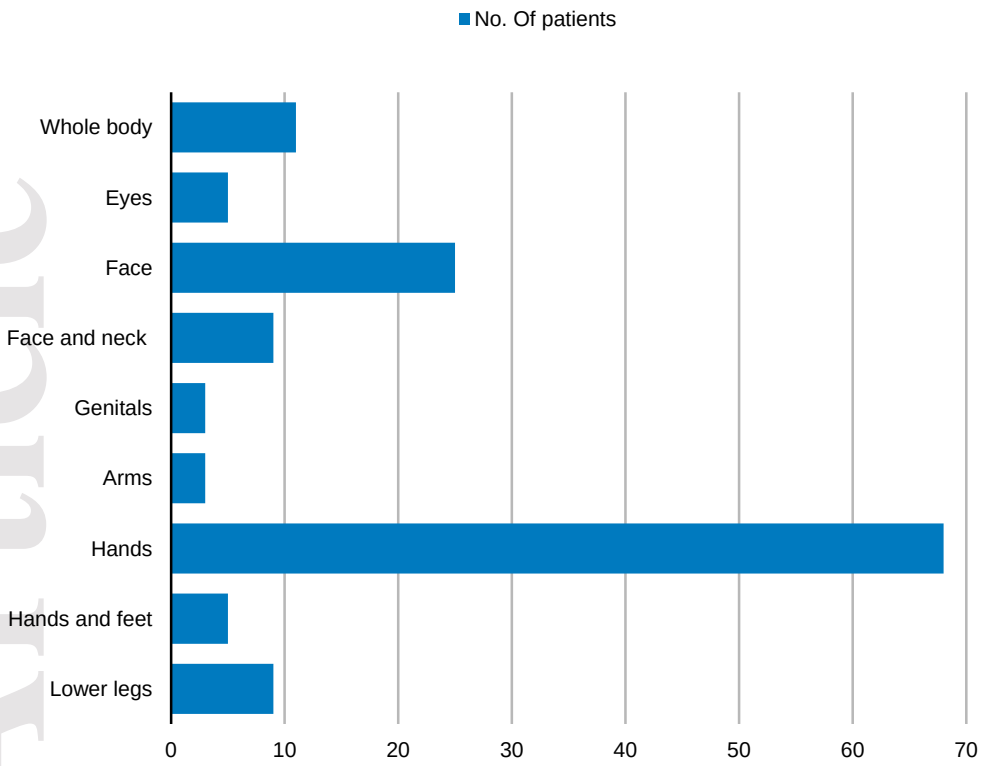

Figure 1. Primary site of dermatitis (many patients had more than one affected site).

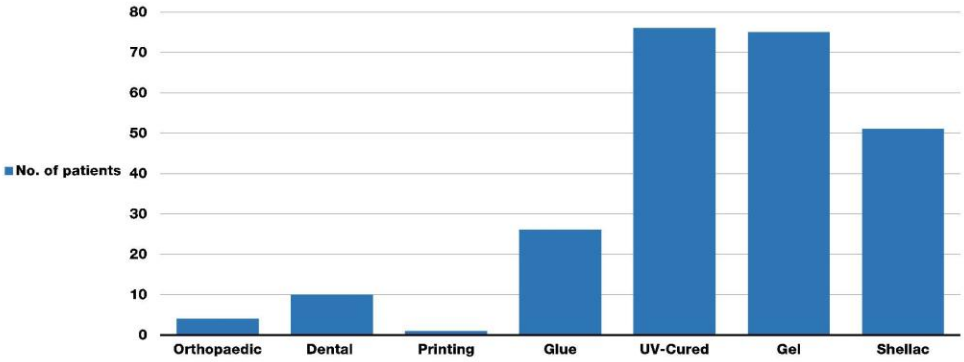

Figure 2. Source of (meth)acrylate exposure reported by patients. Acrylic nails: gel polish (Shellac®), gel and UV-cured nails were the predominant source of exposure, compared to historical sources of exposure such as the printing industry and dentistry. Many patients reported more than one source of exposure.