

Contact sensitization in dental technicians with occupational contact dermatitis. Data of the Information Network of Departments of Dermatology (IVDK) 2001–2015

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Summary

Background. Dental technicians (DTs) are at increased risk for allergic contact sensitization.

Objectives. To assess the current spectrum of occupational sensitization in DTs with occupational contact dermatitis (OCD).

Methods. A retrospective analysis of Information Network of Departments of Dermatology patch test data from the years 2001–2015 concerning DTs with OCD was performed.

Results. Patients of the study group (226 DTs with OCD) were significantly more often diagnosed with allergic contact dermatitis (37.6% versus 18.5%; $p = 0.0002$) than patients of the control group (124 DTs without OCD). In the study group, positive reactions were most frequently observed to methacrylates and/or acrylates ($n = 67$). Of these, 61 patients showed positive reactions to at least one of the five most frequent allergens in this group, namely 2-hydroxyethyl methacrylate, 2-hydroxypropyl methacrylate, methyl methacrylate, ethyl methacrylate, and/or ethylene glycol dimethacrylate. In contrast, no positive reactions to diurethane dimethacrylate (DUDMA) occurred. Among allergens of the German Contact Dermatitis Research Group series 'dental metals', positive reactions were less frequent and were mainly to palladium chloride ($n = 6$).

Conclusions. The present data analysis showed that the sensitization spectrum and spectrum of cross-reactivity are largely unchanged as compared with the 1990s. It can be concluded that test recommendations are still valid and useful, except for the methacrylate DUDMA, which could be omitted.

Key words: acrylates; contact allergy; dental technicians; patch testing.

While manufacturing or repairing dentures, dental technicians (DTs) are exposed to uncured plastic resins, mainly acrylates and methacrylates, as liquids or

powders, and to metals such as cobalt, palladium, and gold, all of these materials being potential contact allergens (1–5). Improved skin protection at the workplace has reduced allergen exposure and the frequency of occupational dermatitis in DTs in the last decades (6). Nevertheless, allergen contact with the hands, forearms or face still occurs (7, 8), either because of the wearing of insufficiently protective gloves, or because of airborne dust exposure during the grinding of freshly cured plastic or metal parts. In addition, wearing elastic protective gloves carries the risk of sensitization to rubber chemicals (9, 10).

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On the basis of a study on occupational contact dermatitis (OCD) in DTs, and data of the German Contact Dermatitis Research Group (DKG) and the Information Network of Departments of Dermatology (IVDK) from the 1990s (8, 11, 12), the DKG recommends patch testing DTs with suspected OCD with the baseline series and the DKG test series 'dental technicians' and 'dental metals' (13, 14), which have undergone only marginal changes during the last 15 years. The objective of our study was to describe the current spectrum of occupational sensitization in DTs with OCD, in order to determine whether the DKG recommendations are still valid. For this purpose, IVDK data concerning DTs from the years 2001–2015 were retrospectively analysed.

Patients and Methods

The objective of the IVDK, which currently has 56 members in Germany, Switzerland, and Austria, is the clinical epidemiology of contact allergy. The structure and routine operating procedures of the IVDK are described in detail elsewhere (15). Patch test results of all patients tested in the participating centres are documented in a standardized way, together with clinical data, including profession, allergen exposure, indication for patch testing, etc. Data are recorded in local databases and, after anonymization, transmitted to the IVDK central office at the University Medical Centre Göttingen twice yearly. There, data undergo standardized quality control, are added to the central IVDK database, and are analysed according to published standards (16, 17). For this retrospective data analysis, we selected data from the years 2001–2015 from the central IVDK database.

Altogether, 163 261 patients were patch tested in the IVDK in these years, and, of these, 399 were DTs (current profession at the time of patch testing). According to the final assessments, 226 DTs suffered from OCD, and 124 did not. For 49 patients, no decision was made in this respect or no information on work-relatedness was given. The 226 DTs with OCD formed the study group for the present analysis. For the comparison of reactions to ubiquitous allergens, the 124 DTs without OCD served as a control group.

All IVDK members are also members of the DKG. Patch tests are performed and read according to DKG and ESCD guidelines (18, 19). For this data analysis, patch test reactions on day (D) 3 were selected. In only a few exceptional cases, when a reading was performed on D4 instead of D3, the D4 reading was chosen. Readings coded as +, ++, or +++, that is, positive reactions with erythema, infiltration, papules, and/or (coalescing) vesicles, according to scoring, were rated as positive in dichotomized analyses. Most patch test preparations were purchased from

Table 1. MOAHLFA indices of 226 dental technicians (DTs) with occupational contact dermatitis (OCD) (study group) and 124 DTs without OCD (control group)

	Study group (n = 226)		Control group (n = 124)		Chi ² -test <i>p</i> -value
	No.	%	No.	%	
Male	105	46.5	39	31.5	0.006
Occupational dermatitis	226	100.0	0 ^a	0.0	NT
Atopic dermatitis (past or present)	67	29.6	40	32.3	0.61
Hand dermatitis	200	88.5	42	33.9	<0.0001
Leg dermatitis	0	0.0	3	2.4	0.044 ^b
Face dermatitis	12	5.3	28	22.6	<0.0001
Age ≥ 40 years	117	51.8	65	52.4	0.91

NT, not tested because the difference is attributable to group definition.

^aNo observation, because of group definition.

^bBecause of a small expected single cell content, Fisher's exact test was used instead of the χ^2 -test.

Almirall Hermal (Reinbek, Germany) from 2001 to 2013, and from SmartPractice Europe (Reinbek, Germany) from 2014 onwards. A few test preparations were obtained from Chemotechnique (Vellinge, Sweden). The patch test exposure times were 2 days in 81% of the patients, and 1 day in 19% of the patients. With a few (temporary) exceptions, Finn Chambers[®] on Scanpor[®] tape (8 mm inner diameter) were used as test chambers.

In order to allow a meaningful comparison of sensitization frequencies between the study and the control group, reaction prevalence rates were standardized for age and sex by the use of previously published methods (20, 21). The statistical significance ($p < 0.05$) of differences in sensitization frequencies was determined by the use of non-overlapping 95% confidence intervals (CIs) of reaction prevalence rates (22). Differences in proportions of population characteristics between the study group and the control group were tested for statistical significance with the chi²-test. Data management and analysis were performed with the statistical analysis software SAS[®], version 9.4 (SAS Institute, Cary, NC, USA).

Results

A short description of the study group (226 DTs with OCD) and the control group (124 DTs without OCD) according to the MOAHLFA index is shown in Table 1. Hand dermatitis was far more prevalent in the study group (88.5% versus 33.9%), and face dermatitis was significantly less frequent (5.3% versus 22.6%, both $p < 0.0001$). There was no difference in the prevalence of atopic dermatitis

Table 2. Age- and sex-standardized frequencies of reactions, supplemented with 95% confidence intervals (95%CI), to those allergens of the baseline series to which at least 3 patients (> 1%) of the study group had a positive reaction. All allergens in pet., except where indicated otherwise

Substance	Test concentration	Number of patients tested	Study group		Control group		
			Patients with positive reactions	Age- and sex-standardized % positive (95%CI)	Number of patients tested	Patients with positive reactions	Age- and sex-standardized % positive (95%CI)
Nickel sulfate	5%	193	27	16.3 (10.6–22.0)	109	14	12.6 (6.5–18.7)
Fragrance mix I	8%	196	19	10.2 (5.6–14.9)	111	8	7.0 (2.3–11.7)
Methylchloroisothiazolinone/methylisothiazolinone	0.01% aq.	197	14	7.4 (3.5–11.3)	111	3	2.5 (0.0–5.3)
Colophonium	20%	197	11	6.0 (2.3–9.7)	111	7	6.3 (1.7–10.8)
Cobalt chloride	1%	193	10	4.9 (1.8–8.0)	111	4	3.6 (0.1–7.1)
Methylisothiazolinone ^a	0.05% aq.	86	7	11.5 (1.3–21.6)	42	2	5.4 (0.0–13.1)
Methyldibromo glutaronitrile ^b	0.2%	110	7	7.4 (1.3–13.5)	54	1	1.6 (0.0–4.8)
Hydroxyisohexyl 3-cyclohexene carboxaldehyde	5%	184	7	4.3 (1.0–7.7)	109	3	2.8 (0.0–5.9)
Balsam of Peru (<i>Myroxylon pereirae</i>)	25%	197	7	3.5 (0.7–6.4)	111	3	2.9 (0.0–6.2)
Fragrance mix II	14%	139	6	4.9 (0.8–9.1)	87	4	4.5 (0.1–8.9)
Ammoniated mercury ^c	1%	157	6	4.3 (0.9–7.7)	76	2	2.5 (0.0–5.9)
Oil of turpentine	10%	198	6	3.3 (0.4–6.1)	111	3	2.7 (0.0–5.8)
Ylang-ylang (I+II) oil ^d (<i>Cananga odorata</i>)	10%	92	5	6.5 (0.4–12.6)	40	1	2.5 (0.0–7.4)
Formaldehyde	1% aq.	196	5	2.7 (0.1–5.3)	109	1	0.9 (0.0–2.6)
Methyldibromo glutaronitrile ^b	0.3%	40	4	6.6 (0.4–12.8)	39	2	3.9 (0.0–8.9)
Propolis	10%	198	4	2.2 (0.0–4.5)	111	1	1.0 (0.0–2.9)
Potassium dichromate	0.5%	194	4	1.7 (0.0–3.6)	111	2	1.8 (0.0–4.3)
Lanolin alcohols	30%	197	4	1.6 (0.0–3.2)	111	1	(0.0–2.7)
<i>o</i> -Phenylenediamine ^c	1%	80	3	5.1 (0.0–11.0)	39	2	4.2 (0.0–10.0)
Jasmin absolute ^d	5%	91	3	4.2 (0.0–9.5)	39	1	2.9 (0.0–8.6)
Epoxy resin	1%	187	3	2.0 (0.0–4.3)	112	0	0.0 (0.0–3.2)
Thiuram mix	1%	197	3	1.7 (0.0–3.7)	111	0	0.0 (0.0–3.3)

Variations in the number of patients tested with each allergen are mostly attributable to patients' individual circumstances or changes in the baseline series during the 15-year study period. The vehicle was pet. unless otherwise indicated. Lower limits of the 95%CI of the reaction frequencies were truncated to 0.0.

^aReduced number of patients because the allergen was not part of the baseline series before January 2014.

^bReduced number of patients because of a reduction in the test concentration from 0.3% to 0.2% in August 2008.

^cReduced number of patients because the allergen was removed from the baseline series in January 2005.

^dReduced number of patients because the allergen was not part of the baseline series before September 2010.

(AD). The age distribution was similar in both groups, but there were more men in the study group (46.5% versus 31.5%, $p = 0.006$). Among DTs with OCD, significantly more patients than in the control group were diagnosed with allergic contact dermatitis (37.6% versus 18.5%; $p = 0.0002$) and chronic irritant contact dermatitis (27.0% versus 4.8%; $p < 0.0001$), respectively.

The DKG baseline series was patch tested in 203 patients (90%) of the study group and in 112 patients (90%) of the control group. Therefore, a bias of frequencies of reactions to these allergens resulting from patient selection can largely be excluded. The results are shown in Table 2. We limited our comparison to those allergen preparations to which at least 3 patients (> 1%) of the study group showed positive reactions. There were no significant differences between the study group and the control group concerning the baseline series.

As mentioned above, two DKG test series include allergens that are occupationally relevant for DTs, namely the 'dental technicians' and 'dental metals' series. The first was patch tested in 172 DTs with OCD, and the latter in 129. However, some clinics tested with modified, clinic-specific test series. Thus, more patients were tested with most allergens considered. Test results for both patients tested with the DKG test series and those tested with clinic-specific test series are shown in Table 3. Methacrylates were the most common allergens, followed by acrylates, whereas metal allergy was observed far less frequently. Sixty-seven patients reacted to methacrylates and/or acrylates. Of these, 63 patients reacted to at least one methacrylate, and 24 patients to one or both of the acrylates tested. Concomitant reactions were frequent. Figure 1 shows the frequency of multiple reactions to acrylates and methacrylates. Twenty-eight patients (42% of 67) reacted to only one or two acrylates/methacrylates, whereas 22 (33%) reacted to more than five acrylates/methacrylates. Sixty-one patients showed positive reactions to at least one of the five most frequent allergens in this group, namely 2-hydroxyethyl methacrylate (HEMA), 2-hydroxypropyl methacrylate (HPMA), methyl methacrylate (MMA), ethyl methacrylate (EMA), and/or ethylene glycol dimethacrylate (EGDMA). Only 2 patients reacted simultaneously to ethyl acrylate (EA) and pentaerythritol triacrylate (PETA), constituting 29% of the 7 reacting to PETA, and 11% of the 19 reacting to EA. The full pattern of concomitant reactivity is shown in detail in Table S1.

Positive test reactions to allergens of the 'dental metals' series were far less frequent. Palladium chloride was the most frequent allergen (Table 3). In 123 patients, palladium chloride was tested in parallel with nickel sulfate. Among these, 19 reacted to nickel sulfate (15%), and 4

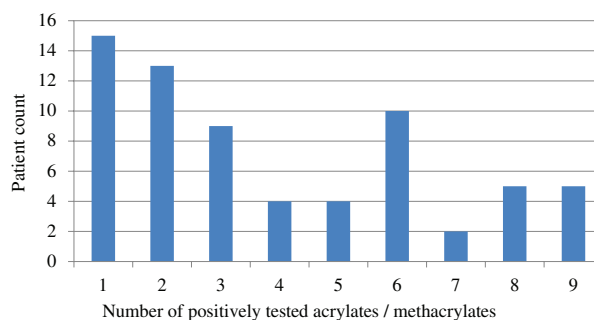


Fig. 1. Concomitant reactions to acrylates and methacrylates in the study group; number of patients who reacted to one, two, three, four, five, six, seven, eight or nine acrylates/methacrylates.

(3%) to palladium chloride. All of the latter patients also reacted to nickel sulfate. Concomitant reactivity to ammoniated mercury and amalgam was not as marked. Both test preparations were tested in 123 patients, of whom 4 reacted to ammoniated mercury and 5 to amalgam, and, of these, 3 reacted to both.

Theoretically, DTs, in particular female DTs, may also be exposed non-occupationally to methacrylates by using artificial nails. However, nail cosmetics or artificial nails were listed as potential (additional) allergen exposures in only 1 female DT with OCD, and in none of the men. Nevertheless, we analysed the frequencies of reactions to the occupational allergens mentioned in Table 3 separately in female and male DTs with OCD. The results are shown in Table S2. There were no significant differences between the sexes, as shown by overlapping 95% CIs of percentages of positive reactions throughout.

Discussion

With the data presented here, we describe the current spectrum of occupational sensitization in DTs, and verify the validity of the corresponding DKG patch test recommendations. However, as we have no data concerning potential (unknown) new occupational allergens in dental laboratory technology, our findings are limited to those allergens that are available for, and have been used in, patch testing.

The frequencies of sensitization to ubiquitous allergens in a certain patient population may be influenced by factors described by the MOAHLEA index. As is generally to be expected in OCD patients, hand dermatitis was far more frequent in the study group than in the control group. Allergic OCD in DTs is mainly located on the fingertips, along the fingers, and on the backs of the hands (10, 23), and all of these anatomical sites are summarized under 'hands' in Table 1. Hence, our data are similar to

Table 3. Patch test results with allergens from the German Contact Dermatitis Research Group test series 'dental technicians' and 'dental metals' in the study group. Except for copper sulfate, which was tested in aq., the vehicle was pet. throughout

Allergen	Test concentration	No. tested	Negative	?+	+	++	+++	Irritant	% positive
Dental technicians series									
Acrylates									
Ethyl acrylate	0.1	175	151	5	17	2	0	0	10.9
Pentaerythritol triacrylate	0.1	174	164	3	6	1	0	0	4.0
Methacrylates									
2-Hydroxyethyl methacrylate	1	188	138	10	25	15	0	0	21.3
2-Hydroxypropyl methacrylate	2	188	137	11	24	16	0	0	21.3
Methyl methacrylate	2	194	145	7	25	16	0	1	21.1
Ethyl methacrylate	2	174	133	8	27	6	0	0	19.0
Ethylene glycol dimethacrylate	2	189	145	11	22	11	0	0	17.5
Triethylene glycol dimethacrylate	2	193	164	9	14	4	0	2	9.3
Tetrahydrofurfuryl methacrylate	2	174	151	7	14	2	0	0	9.2
1,4-Butanediol dimethacrylate	2	187	166	5	14	2	0	0	8.6
Diurethane dimethacrylate	2	147	144	3	0	0	0	0	0.0
Others									
Benzoyl peroxide	1	199	165	11	14	3	2	4	9.5
Melamine formaldehyde resin	7	167	153	3	6	5	0	0	6.6
Dental metals series									
Palladium chloride	1	137	125	5	5	1	0	1	4.4
Amalgam	5	125	114	6	4	1	0	0	4.0
Ammoniated mercury	1	162	149	7	4	2	0	0	3.7
Tin(II) chloride	0.5	128	126	0	2	0	0	0	1.6
Gold sodium thiosulfate	0.25	131	129	1	0	1	0	0	0.8
Amalgam alloy metals	20	127	126	0	1	0	0	0	0.8
Ammonium tetrachloroplatinate	0.25	132	132	0	0	0	0	0	0.0
Copper(II) sulfate pentahydrate	1	140	139	1	0	0	0	0	0.0

study results from the 1980s and 1990s (8, 24). With 88.5% of the OCD patients suffering from hand dermatitis, all other anatomical sites are evidently less frequently affected. However, the very low proportion of patients with face dermatitis (5.3%) among DTs with OCD is reassuring, as it seems to indicate sufficient dust protection at the workplaces by fume hoods, protective shields and face masks. Atopic skin is regarded as a relevant risk factor for OCD (25), and patients with AD are counselled in Germany not to adopt wet work occupations if they had suffered from atopic hand eczema during adolescence (26). In our results, AD was not overrepresented among DTs with OCD as compared with DTs without OCD. One might speculate whether this is the result of a 'healthy worker effect', which we can neither prove nor rule out from our data. However, in our opinion, it seems more probable that successful implementation of primary and secondary preventive strategies in medical professions and, particularly, in AD patients (with hand eczema) has contributed to this outcome. Moreover, dental professionals in Germany are given specific information on appropriate protective measures (14, 27, 28), such as after-work use of creams (29). According to information from the German Federal Employment Agency, approximately 60% of the

DTs are women, and 40% are men. Similar proportions were seen among DTs with OCD in our study. Hence, it seems unlikely that preventive measures are significantly less frequently taken by male DTs than by female DTs, as has been reported in metalworkers (30).

Patch testing with allergens of the DKG baseline series showed no significant differences in sensitization frequencies between the study group and the control group. This finding is in line with a former IVDK data analysis and a German study on OCD in DTs from the 1990s (8, 11). Short and repeated skin contact with dental tools and alloys has been reported to possibly lead to the deposition of large amounts of nickel, cobalt and chromium on the skin in DTs (1). However, we did not find an increase in the prevalence of sensitization to these metals in DTs with OCD. In our opinion, this underlines the effectiveness of preventive measures. Another remarkable finding is that, despite presumed frequent use of protective gloves among DTs, we did not find an increased frequency of sensitization to rubber chemicals. The nitrile gloves that are recommended for DTs protect for no longer than 10 min against acrylates/methacrylates (28). Hence, wearing time is supposed to be rather short, and possibly too short to release relevant amounts of vulcanization agents.

In addition, the most preferred combination of hand protection against acrylates/methacrylates is wearing a polyethylene glove underneath a nitrile glove (28). With this combination, there is no exposure to vulcanization agents at all.

Concomitant reactivity to nickel sulfate and palladium chloride frequently occurs, and is partly attributable to cross-reactivity at the T cell clonal level in patients primarily sensitized to nickel (31–34). In our study, palladium was the most frequent allergen among the dental metals tested. Among those patients tested with both haptens, that is, nickel sulfate and palladium chloride, all palladium-positive patients also reacted to nickel. Hence, the primary sensitization may have been to nickel, acquired, for instance, by the use of costume jewellery (14). Primary palladium allergy has been reported in patients with oral mucosal complaints caused by dental crowns (32), but it has rarely been reported as an occupational contact allergen in DTs (34).

Positive reactions to amalgam and ammoniated mercury occurred almost as frequently as reactions to palladium, with partial concomitant reactivity. Positive reactions to these compounds may be clinically relevant in dental patients who suffer from oral lichen planus at the site of dental fillings with amalgam, but neither agent is considered to be an important occupational allergen in DTs (8, 10, 35–37). Because of the sensitizing and toxic properties of mercury, the use of amalgam in restorative dentistry has substantially decreased, and it has been increasingly replaced by plastics and other alternative materials (14, 38, 39).

Without doubt, gold is an important allergen in dental patients with mucosal complaints adjacent to gold crowns etc. (9, 40). However, in line with the literature, according to our data it seems not to be an important occupational allergen in DTs, although we may have missed some cases of sensitization, because gold tends to give late patch test reactions (40, 41), and we did not perform routine readings beyond D3 or D4. The remainder of the 'dental metals' series comprises amalgam alloy metals, that is, silver, copper, tin, zinc, tin chloride, copper sulfate, and ammonium tetrachloroplatinate. Only single reactions were seen to these test substances. According to the literature, these metals are rarely relevant occupational sensitizers in DTs (9). Hence, it seems debatable whether routine patch testing with this 'dental metals' series should still be recommended in DTs with OCD, or whether it should possibly be restricted to cases with a specific suspicion of metal allergy.

Methacrylates and acrylates, which are used in the manufacture and repair of dental prostheses, were identified as the main causes of allergic OCD in DTs

years ago (3, 5, 8, 39). According to our data, they still represent the most important occupational sensitizers in DTs. In our study, approximately one-third of the DTs with OCD reacted to methacrylates and/or acrylates. In accordance with previous IVDK reports (8), and also with Finnish data published more recently (3), sensitization to methacrylates occurs more frequently than sensitization to acrylates, with HEMA, HPMA, MMA, EMA and EGDMA being the leading allergens. Although concomitant reactions were frequent, we could not identify one single methacrylate that could serve as a marker allergen in patch test screening in this analysis. Remarkably, there were no positive reactions to diurethane dimethacrylate (DUDMA); hence dropping this methacrylate from the 'dental technicians' series might be considered in the future.

In modelling or gluing of artificial nails, similar methacrylates to those used in the dental laboratory are used, and corresponding sensitization may be acquired in this way by nail artists and customers (42). However, artificial nails were mentioned by only 1 of our patients as a possible allergen source (in addition to occupational contactants). Hence, a bias of our results attributable to this exposure can largely be excluded. In line with this, we did not find any significant differences in sensitization frequencies between the sexes.

At first sight, the consistently high prevalence of sensitization to methacrylates and acrylates among DTs with OCD seem to challenge the efficacy of preventive measures. However, in the 1990s, DTs constituted 2.1% of OCD patients patch tested in the IVDK, whereas this proportion was only 0.9% in our study period. In our opinion, this shows that prevention programmes were successful, but that, in the (fewer) current cases of OCD among DTs, relevant contact allergens largely remained the same. Although our data provide a survey on sensitization in a comparably large group of DTs with OCD, we have no reliable data on the patients' individual exposures. Hence, we cannot comment on the clinical relevance of the sensitizations in every case. However, detailed analyses of this aspect have been published by the Finnish Institute of Occupational Health (3), and have shown that the methacrylates and acrylates are relevant in this trade. On the other hand, we have no indication from the literature that relevant allergens are missing in our 'dental technicians' series.

In summary, the present IVDK data analysis shows that the spectrum of sensitization to common and occupational allergens and the spectrum of concomitant reactivity in DTs with OCD are largely unchanged, as compared with the 1990s. We conclude that the DKG test recommendations for DTs with OCD from 2000 (13) are

still generally valid and useful. However, in our opinion, DUDMA could be dropped from the 'dental technicians' series, and patch testing with the 'dental metals' series could be restricted to cases with specific suspicion of metal allergy. It should be noted that, in individual cases, unexpected allergens may be responsible for OCD in DTs. This has been described for colophonium and propolis in moulding material (43, 44).

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Patterns of concomitant reactions to acrylates and methacrylates in 67 study group patients reacting to methacrylates and/or acrylates.

Table S2. Comparison of frequencies of reactions to allergens from the DKG test series 'dental technicians' and 'dental metals' among female and male dental technicians (DTs) with occupational contact dermatitis (OCD). Except for copper sulfate, which was tested in aq., the vehicle was pet. throughout.

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Table S1.

Patterns of concomitant reactions to acrylates and methacrylates in 67 study group patients reacting to methacrylates and/or acrylates.

Sensitization to	MMA	EMA	THFMA	HEMA	HPMA	EGMA	BUDMA	TEGMA	PETA	EA	Patient count	Percent
1 -2 (meth)acrylates	+										5	7.5
										+	1	1.5
				+							3	4.5
					+						1	1.5
						+					1	1.5
								+			1	1.5
									+		3	4.5
	+	+									2	3.0
	+			+							3	4.5
	+				+						1	1.5
		+			+						2	3.0
			+				+				1	1.5
				+				+			1	1.5
					+					+	1	1.5
				+	+						2	3.0
3 (meth)acrylates	+			+		+					3	4.5
	+	+				+					1	1.5
	+	+								+	1	1.5
					+	+		+			1	1.5
				+	+			+			1	1.5
				+	+	+					1	1.5
						+		+		+	1	1.5
4 (meth)acrylates	+			+	+	+					1	1.5
	+	+		+	+						2	3.0
			+	+	+	+					1	1.5
5 (meth)acrylates	+	+		+	+	+					1	1.5
		+	+		+		+			+	3	4.5

>5 (meth)acrylates	+	+		+	+	+				+	3	4.5
	+	+		+	+	+			+	+	1	1.5
	+	+	+	+	+	+		+		+	2	3.0
	+	+		+	+	+	+		+	+	1	1.5
	+	+	+	+	+	+	+	+		+	5	7.5
	+	+	+	+	+	+					1	1.5
	+	+		+	+	+			+		1	1.5
	+	+		+	+	+		+			2	3.0
	+	+		+	+	+	+				2	3.0
	+	+		+	+	+	+	+			1	1.5
	+	+	+	+	+	+	+	+			2	3.0
			+		+	+	+	+	+		1	1.5

Table ~~S1~~S2.

Comparison of reaction frequencies to allergens from the DKG test series “dental technicians” and “dental metals” among female and male dental technicians (DT) with occupational contact dermatitis (OCD).

Except for copper sulfate, which was tested in water, vehicle was petrolatum throughout.

Allergen	Test concentration	Female DT with OCD Percent positive reactions with 95%-CI [in brackets]	Male DT with OCD Percent positive reactions with 95%-CI [in brackets]
Dental technicians series			
Acrylates			
Ethyl acrylate (EA)	0.10	9.6 [4.5 – 17.4]	12.3 [6.1 – 21.5]
Pentaerythritol triacrylate (PETA)	0.10	5.4 [1.8 – 12.1]	2.5 [0.3 – 8.6]
Methacrylates			
2-Hydroxyethyl methacrylate (HEMA)	1.00	20.0 [12.5 – 29.5]	22.6 [14.6 – 32.4]
2-Hydroxypropyl methacrylate (HPMA)	2.00	23.2 [15.3 – 32.8]	19.1 [11.5 – 28.8]
Methyl methacrylate (MMA)	2.00	19.4 [12.1 – 28.6]	22.9 [15.0 – 32.6]
Ethyl methacrylate (EMA)	2.00	19.4 [11.9 – 28.9]	18.5 [10.8 – 28.7]
Ethylene glycol dimethacrylate (EGDMA)	2.00	17.5 [10.6 – 26.6]	17.4 [10.3 – 26.7]
Triethylene glycol dimethacrylate (TEGDMA)	2.00	10.2 [5.0 – 18.0]	8.4 [3.7 – 15.9]
Tetrahydrofurfuryl methacrylate (THFMA)	2.00	8.6 [3.8 – 16.2]	9.9 [4.4 – 18.5]
1,4-Butanediol dimethacrylate (BUDMA)	2.00	8.2 [3.6 – 15.6]	8.9 [3.9 – 16.8]
Diurethane dimethacrylate (DUDMA)	2.00	0.0 [0.0 – 4.0]	0.0 [0.0 – 4.0]
Others			
Benzoylperoxide	1.00	13.9 [7.8 – 22.2]	5.1 [1.7 – 11.5]
Melamine formaldehyde resin	7.00	4.3 [1.2 – 10.6]	9.5 [3.9 – 18.5]
Dental metals series			
Palladiumchloride	1.00	6.5 [2.1 – 14.5]	1.7 [0.0 – 8.9]
Amalgam	5.00	7.0 [2.3 – 15.7]	0.0 [0.0 – 5.4]
Mercury(II) amidochloride	1.00	6.9 [2.6 – 14.4]	0.0 [0.0 – 3.9]
Tin(II) chloride	0.50	1.4 [0.0 – 7.3]	1.9 [0.0 – 9.9]
Gold sodium thiosulfate	0.25	1.4 [0.0 – 7.3]	0.0 [0.0 – 5.1]
Amalgam alloy metals	20.00	1.4 [0.0 – 7.6]	0.0 [0.0 – 5.2]

Ammonium tetrachloroplatinate	0.25	0.0 [0.0 – 3.9]	0.0 [0.0 – 5.1]
Copper(II)sulfate pentahydrate	1.00	0.0 [0.0 – 3.9]	0.0 [0.0 – 4.6]

95%-CI = 95%-confidence interval.