

# Hairdressers presenting to an occupational dermatology clinic in Melbourne, Australia

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doi:10.1111/cod.12016

## Summary

**Background.** Hairdressers constitute one of the largest occupational groups attending our occupational dermatology clinic in Melbourne, Australia.

**Objectives.** To perform a retrospective review of the clinical assessments of hairdressers and trainee hairdressers attending our clinic, including patch testing results.

**Patients/materials/methods.** We used our clinic database to identify trainee and qualified hairdressers who had attended our occupational dermatology clinic between January 1993 and December 2010.

**Results.** One hundred and sixty-four hairdressers and hairdressing apprentices were identified. One hundred and fifty-seven had a diagnosis of occupational contact dermatitis (OCD), with allergic contact dermatitis being the primary diagnosis in 71% and irritant contact dermatitis in 20%. Involvement of more than one body part was suggestive of allergic contact dermatitis ( $p = 0.05$ ). Sixty-five per cent of participants were found to have more than one factor contributing to their OCD. Allergic contact dermatitis was more common in apprentices than in qualified hairdressers. Ammonium persulfate, *p*-phenylenediamine, toluene-2,5-diamine and glyceryl monothioglycolate were the most common occupational allergens. Nickel allergy was seen in 31% of hairdressers, but considered to be occupationally relevant in only 3%.

**Conclusions.** Multiple sensitizations and multiple factors contributing to OCD in hairdressers are common. More needs to be done to prevent the development of OCD in hairdressers in our geographical region.

**Key words:** allergy; apprentice; contact dermatitis; contact urticaria; glove; hair dye; hand eczema; irritant; latex allergy; patch testing; *p*-phenylenediamine.

Hairdressing is one of the most hazardous occupations for the skin. Contact dermatitis of the hands is a well-recognized and frequently observed condition in the hairdressing industry (1), and a major cause of leaving the profession (2). A past or present history of occupational contact dermatitis (OCD) has been reported in up to

50% of hairdressers (3–5). Prevention of dermatitis in hairdressers is difficult. From an occupational hygiene perspective, the imposition of control measures in a hairdressing situation is challenging, although substitution of less allergenic chemicals has been achieved successfully in Germany by eliminating glyceryl monothioglycolate (6). Education of the workforce with regard to the correct handling of hazardous substances is often suboptimal, and, for a variety of reasons, the use of personal protective equipment is often inadequate (7, 8). When implemented, education programmes on occupational dermatitis have been shown to increase the use of gloves and reduce the incidence of hand eczema in apprentice hairdressers (9).

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Conflicts of interest: The authors have declared no conflicts.

Accepted for publication 2 October 2012

Frequent wet work and exposure to numerous irritants and allergens place hairdressers at significant risk of developing irritant contact dermatitis and, subsequently, allergic contact dermatitis (2, 10). Common allergens include *p*-phenylenediamine in hair dyes, ammonium persulfate in bleach, and glyceryl monothioglycolate in permanent wave solutions.

Results of patch testing in hairdressers have been reported by a number of centres (11–19), and have shown differing frequencies of sensitization to a wide range of allergens. These differences may relate to different hairdressing practices in different geographical locations, as well as legislation banning the use of certain chemicals in some countries (6). The rate of allergic contact dermatitis in hairdressers presenting with dermatitis also differs markedly between studies, with reported rates of 38% (19), 58% (16), 61% (18), and 80% (11). Rates of irritant contact dermatitis in hairdressers with dermatitis have been reported to be 16–35% (11, 16, 19). We present the Australian perspective in order to contribute to the understanding of this worldwide problem.

## Methods

All referrals involving hairdressers who attended our occupational dermatology clinic between 1 January 1993 and 31 December 2010 were retrieved from our clinic database. The database contains the relevant demographic, clinical, patch testing and diagnostic data obtained from all patients attending the clinic, which is based at the Skin and Cancer Foundation, Melbourne, Victoria. All patients with a past or present history of involvement in the hairdressing industry, including trainees, students, and apprentices, were included in the study.

Almost all patients had been assessed by the same occupational dermatologist (R. Nixon). The allergens used for patch testing were obtained from Chemotechnique Diagnostics® (Vellinge, Sweden) and applied to the back with Finn Chambers® on Scanpor® tape (Epitest OY, Tuusula, Finland). Patches were removed after 48 hr, and test readings were performed at D2 and D4. Patients were generally tested with an extended European baseline series, cosmetics series, hairdressers' series, and their own samples appropriately diluted. Patients were tested with additional series, for example a rubber series, if clinically relevant. Positive patch test reactions were assessed for relevance by the occupational dermatologist. When there was a history of exposure to natural rubber latex, patients were also tested for latex protein allergy, usually with a screening radio-allergosorbent test. Patients were then diagnosed with allergic contact

dermatitis, irritant contact dermatitis, contact urticaria (caused by natural rubber latex proteins or ammonium persulfate), endogenous eczema, mucosal atopy, or other conditions. Endogenous eczema included the diagnosis of atopic eczema and other forms of eczema, such as seborrhoeic or discoid eczema. When there were multiple contributory factors, the diagnosis thought to be most contributory to the OCD was referred to as the primary diagnosis. The severity of the skin conditions was assessed on initial presentation with use of the occupational dermatitis disease severity index (ODDI) (20). The ODDI score rates severity of OCD on a scale of 1–5, based on disease course, treatment, clinical signs, and impact on work-related activities.

## Statistical analysis

The statistical package STATA™ (Version 9.0; StataCorp, College Station, TX, USA) was used to perform all statistical analysis. A chi-squared test was used for binary data, and a *t*-test was used for normally distributed continuous data. A Mann–Whitney *U*-test was used to compare differences in scores where data had a non-parametric distribution. A two-sided *p*-value of  $\leq 0.05$  was considered to be statistically significant.

## Results

### Participants

Of the 164 participants, 72 (44%) were apprentices and 92 (56%) were qualified hairdressers at the time of examination. The mean age of participants at assessment was 23 years, and there were 7 males and 157 females in the cohort.

### Primary diagnosis

Allergic contact dermatitis was the primary diagnosis in 117 participants (71%), and, in all cases, was assessed as being relevant to hairdressing. Irritant contact dermatitis was the primary diagnosis in 33 participants (20%), and the overall prevalence of irritant contact dermatitis in the cohort was 57%. Endogenous eczema was the primary diagnosis in 6 participants (4%), and contact urticaria, caused predominantly by latex and, in 1 case, by ammonium persulfate, was the primary diagnosis in 7 (4%). One participant (<1%) presented with paronychia that was thought to be occupationally related. Therefore, 157 of the 164 subjects (95.7%) were diagnosed with OCD and 158 of 164 (96.3%) with occupational skin disease. Of those with OCD, 117 of 157 (75%) had a

**Table 1.** Primary diagnosis as a function of level of training

	Apprentice hairdresser (n = 72), no. (%)	Qualified hairdresser (n = 92), no. (%)	Total (n = 164) no. (%)	<i>p</i> -value
Allergic contact dermatitis	58 (81)	59 (64)	117 (71)	0.021
Irritant contact dermatitis	11 (15)	22 (24)	33 (20)	0.171
Contact urticaria	3 (4)	4 (4)	7 (4)	0.955
Endogenous eczema	0	6 (7)	6 (4)	0.035
Other	0	1 (1)	1 (1)	0.375

Between apprentices and hairdressers,  $\chi^2 = 8.5055$ ,  $p = 0.048$ .

primary diagnosis of allergic contact dermatitis, and 33 of 157 (21%) had a primary diagnosis of irritant contact dermatitis. It is of note that apprentices had a higher rate of allergic contact dermatitis than qualified hairdressers ( $p = 0.021$ ; Table 1).

#### Number of diagnoses or contributory factors to skin condition

Fifty-eight participants (35%) had a sole primary diagnosis. In 106 participants (65%), two or more diagnoses were found. Fifty participants (30%) had two diagnoses, with allergic and irritant contact dermatitis being the most common combination. Forty-four participants (27%) had three diagnoses, with allergic contact dermatitis, irritant contact dermatitis and endogenous eczema being the most common combination. Eleven participants (7%) had four diagnoses and 1 had six diagnoses (<1%).

#### Duration of symptoms

Those with allergic contact dermatitis had a shorter mean duration of symptoms (19 months) than those with irritant contact dermatitis (29 months).

#### Patch test results

Table 2 lists the positive patch test results and their clinical relevance. Results were assessed as not relevant if there was no evidence of current exposure to the allergen; this was interpreted rigorously. Ammonium persulfate, *p*-phenylenediamine, glyceryl monothioglycolate, toluene-2,5-diamine and 2-nitro-4-phenylenediamine were the most common clinically relevant allergens, and between them accounted for 50% of positive patch test results. Nickel allergy was observed in 51 participants (31%), but was deemed to be of clinical relevance in

only 5 patients (3%), on the basis of a positive dimethylglyoxime test result (21). Although current hairdressing scissors are predominantly composed of stainless steel, and are rarely dimethylglyoxime-positive, we had several cases of detachable scissor finger rests containing nickel and contributing to allergic contact dermatitis of the little finger on the dominant hand, although not in recent years. A number of hairdressers performed work with acrylic nails, and several of them also reacted to acrylates.

#### Contact urticaria

A number of hairdressers who were allergic to ammonium persulfate on patch testing additionally reported respiratory symptoms, but were not prick tested because of concerns with regard to the safety of prick testing with this substance, given previous reports of anaphylaxis (22, 23). The diagnosis of contact urticaria was made on the basis of positive radio-allergosorbent test results for natural rubber latex proteins and, in 1 case, for ammonium persulfate, based on clinical features. This person was subsequently referred for investigation and follow-up by an allergist.

#### Area of involvement

To assess the extent of skin involvement, we divided the body into six regions: hands, arms, face/head, torso/abdomen, legs, and feet. Contact dermatitis involved the hands in the majority of cases (Table 3). Clinical involvement of more than one body region (Table 4) was highly suggestive of allergic contact dermatitis ( $p = 0.05$ ). Although allergic contact dermatitis usually involved more than one body area, the hands were the only area involved in 34% of cases.

#### Severity of symptoms

The majority of participants received an ODDI score of 3 (52%) or 4 (34%), with the distribution of ODDI scores being skewed towards the more severe end of the spectrum of disease (Table 5). The ODDI scores in our hairdresser subset were significantly higher ( $p = 0.0001$ ) than the average ODDI scores for all contact dermatitis patients seen in our clinic (Table 5).

#### Discussion

Contact dermatitis of the hands constitutes approximately 90–95% of occupational skin disease. Irritant contact dermatitis is the most common diagnosis, and is seen in 70–80% of cases, with allergic contact dermatitis

**Table 2.** Positive patch test results

	Relevant	%	Not relevant	%	Total	%
Ammonium persulfate	68	20	10	8	78	17
<i>p</i> -Phenylenediamine	67	20	1	1	68	15
Nickel	5	1	46	37	51	11
Toluene-2,5-diamine	30	9	4	3	34	7
2-Nitro-4-phenylenediamine	23	7	4	3	27	6
Glyceryl monothioglycolate	25	7	1	1	26	6
Fragrance mix I	5	1	9	7	14	3
Ammonium thioglycolate	10	3	3	2	13	3
4-Aminophenol	10	3	2	2	12	3
Ethylene glycol dimethacrylate	9	2	1	1	10	2
Colophonium	6	2	4	3	10	2
Cocamidopropyl betaine	1	<1	8	6	9	2
2-Hydroxyethyl methacrylate	8	2	0	0	8	2
2-Hydroxyethyl acrylate	8	2	0	0	8	2
Thiuram mix	6	2	2	2	8	2
Lanolin (wool alcohols)	1	<1	6	5	7	2
Triethylene glycol diacrylate	7	2	0	0	7	2
Triethylene glycol dimethacrylate	6	2	1	1	7	2
Amerchol™ L 101	1	<1	6	5	7	2
2-Hydroxypropyl methacrylate	6	2	0	0	6	1
Ethyl acrylate	5	1	0	0	5	1
3-Aminophenol	4	1	1	1	5	1
Tetraethylthiuram disulfide	4	1	1	1	5	1
Tetrahydrofurfuryl methacrylate	3	1	2	2	5	1
Formaldehyde	1	<1	4	3	5	1
MCI/MI	1	<1	4	3	5	1
Ethyl methacrylate	4	1	0	0	4	1
Hydrogen peroxide	1	<1	3	2	4	1
Cinnamal	3	1	0	0	3	1
Tosylamide/formaldehyde resin	2	<1	0	0	2	<1
Methyl methacrylate	2	<1	0	0	2	<1
d-Limonene	2	<1	0	0	2	<1
2-Bromo-2-nitropropane-1,3-diol	1	<1	1	1	2	<1
1,6-Hexanediol diacrylate	1	<1	1	1	2	<1
Diaminodiphenylmethane	1	<1	0	0	1	<1
4-Chloro-3-xyleneol	1	<1	0	0	1	<1
Total	338		125		463	

MCI/MI, methylchloroisothiazolinone/methylisothiazolinone.

**Table 3.** Area of involvement by primary diagnosis

	Hands, no. (%)	Arms, no. (%)	Face, no. (%)	Torso, no. (%)	Legs, no. (%)	Feet, no. (%)
Allergic contact dermatitis (n = 117)	107 (91)	48 (41)	45 (38)	16 (14)	18 (15)	10 (9)
Irritant contact dermatitis (n = 33)	31 (94)	10 (30)	6 (18)	2 (6)	3 (9)	1 (3)
Contact urticaria (n = 7)	6 (83)	2 (33)	2 (17)	1 (17)	0	0
Endogenous eczema (n = 6)	5 (83)	2 (33)	3 (50)	2 (33)	1 (17)	1 (17)
Other (n = 1)	1 (100)	0	0	0	0	0
Total (n = 164)	150 (91)	62 (38)	56 (34)	21 (13)	22 (13)	12 (7)

Between irritant and allergic contact dermatitis,  $\chi^2 = 3.7507$ ,  $p = 0.05$ .

accounting for approximately 20–25%, depending on the study population (24, 25). However, in this study, allergic contact dermatitis was the primary diagnosis in 71% of hairdressers with contact dermatitis. This is in

keeping with the findings of other hairdressing studies, which have also shown a predominance of allergic relative to irritant contact dermatitis (11, 16, 18, 19). This may result from frequent exposure to multiple allergens

**Table 4.** Number of affected body regions by primary diagnosis

	1, no. (%)	2, no. (%)	3, no. (%)	4, no. (%)	5, no. (%)	6, no. (%)
Allergic contact dermatitis (n = 117)	45 (38)	32 (27)	22 (19)	11 (9)	6 (5)	1 (<1)
Irritant contact dermatitis (n = 33)	19 (58)	9 (27)	3 (9)	2 (6)	0	0
Contact urticaria (n = 7)	3 (43)	4 (57)	0	0	0	0
Endogenous eczema (n = 6)	2 (33)	1 (17)	2 (33)	1 (17)	0	0
Other (n = 1)	1 (100)	0	0	0	0	0
Total (n = 164)	70 (43)	46 (28)	27 (16)	14 (9)	6 (4)	1 (<1)

Between irritant and allergic contact dermatitis,  $\chi^2 = 3.8444$ ,  $p = 0.05$ .

**Table 5.** Distribution of occupational contact dermatitis disease severity (ODDI) scores

ODDI score	Hairdressing cohort (n = 131)	%	Random sample from clinic (n = 235)	%
1	0	0	18	8
2	18	14	85	36
3	68	52	86	37
4	45	34	45	19
5	1	<1	1	<1

$\chi^2 = 37.7527$ ,  $p = 0.0001$ .

in hairdressing, particularly ammonium persulfate, *p*-phenylenediamine, and glycerol monothioglycolate. Our allergic contact dermatitis rate of 71% is higher than the 38% reported by Leino et al. (22), but similar to the rates of 58% (16), 60.9% (21) and 80% (11) reported in other hairdressing studies. Although irritant contact dermatitis was the primary diagnosis in only 20% of participants, the overall prevalence of irritant contact dermatitis in this group was 57%, and was thus higher than the rates of 16–35% cited in other hairdressing studies in the literature (11, 16, 22). Allergic and irritant contact dermatitis are difficult to distinguish clinically, and in cases where both are present it can be challenging to determine which is the primary diagnosis.

This study found a higher rate of allergic contact dermatitis in apprentice hairdressers than in qualified hairdressers. This may be attributable to a healthy worker effect in hairdressing, given that skin problems are commonly cited as the reason for leaving the profession (26, 27). Historically, apprentice hairdressers were predominantly exposed to water, shampoo, and conditioners (28). However, in an Australian workplace study, we found that many apprentices and trainee hairdressers now have direct contact with hair dyes, bleach and permanent wave solutions relatively early in their careers (8). Both apprentices and their employers had a poor knowledge of skin hazards, and rarely wore gloves when in contact with allergens, particularly when rinsing off hair treatments at the basin (8). The high rate of allergic

contact dermatitis observed in the apprentices in this study may be explained by these findings: early exposure to allergens, poor understanding of skin hazards and inadequate use of personal protective equipment in apprentices, and a healthy worker effect.

It has been proposed that hairdressers initially develop irritant contact dermatitis, which then predisposes them to develop allergic contact dermatitis (29). However, in this study, hairdressers with allergic contact dermatitis had a significantly shorter duration of symptoms than those with irritant contact dermatitis. Duration of symptoms was taken as the time from first onset of symptoms to time of diagnosis. This would be consistent with our observation that patients with allergic contact dermatitis have a greater severity of disease than those with irritant contact dermatitis (30), prompting these patients to seek medical treatment sooner. In addition, it is also of interest that OCD in our hairdresser cohort is of a more severe nature than that seen in other occupational groups that present to us for patch testing (Table 5).

Ammonium persulfate and *p*-phenylenediamine were the most common hairdressing allergens in this study. In the early period of this study, the use of dust containing bleaches was common, and this may have contributed to the relatively high rate of sensitization to ammonium persulfate, constituting 20% of relevant positive patch test results. Ammonium persulfate sensitization rates of between 8% and 25% have been reported in Europe (12, 18, 31). However, it is also acknowledged that ammonium persulfate can cause irritant reactions on patch testing (32, 33), and so reactions can be difficult to interpret.

The overall prevalence of *p*-phenylenediamine sensitization in a general population of patients with contact dermatitis has been reported as 3.2% (34). Hairdressers have a significantly higher frequency of *p*-phenylenediamine sensitization, as a result of the widespread use of the substance in hair dyes. Sensitization to *p*-phenylenediamine was seen in >40% of participants in this study, which is in keeping with results from some published studies (11, 12, 16, 34). An additional cause of *p*-phenylenediamine sensitization in our population, as seen overseas, has

been exposure to *p*-phenylenediamine-containing so-called 'temporary henna tattoos' (35–38).

Our study confirmed overseas reports (12) of more cases of allergic contact dermatitis caused by glycerol monothioglycolate than caused by ammonium thioglycolate (26 and 13 reactions, respectively). A similar finding led to Germany eliminating the use of glycerol monothioglycolate (6).

The role of nickel as an occupational allergen in hairdressing is a controversial area in contact dermatitis. It has been reported that up to 27% of hairdressers have evidence of nickel sensitivity before significant exposure in the trade (11, 39), which has been attributed to ear piercing and nickel-plated costume jewellery. No correlation has been found between nickel sensitivity at the onset of apprenticeship and the development of hand eczema after 8 years of follow-up (4). The high rate of nickel sensitivity of 31% seen in this study, was considered to be of occupational relevance in only 3% (5 patients). Some studies (21, 40) have proposed that nickel sensitization is occupationally relevant in all hairdressers with contact dermatitis: this is not our opinion.

In a previous study, our group also reported the inappropriate use of powdered disposable latex gloves in hairdressing (8). The use of these gloves predisposes the wearer to the development of latex allergy, and their use should be discouraged. Latex allergy was the primary diagnosis in 6 hairdressers/apprentices in this cohort (4%).

In this study, contact dermatitis involving multiple areas of skin was suggestive of allergic contact dermatitis rather than irritant contact dermatitis ( $p = 0.05$ ). However, the hands were the only area involved in 34%

of patients with allergic contact dermatitis, highlighting the importance of patch testing in making an accurate diagnosis.

Finally, this study demonstrates that there are multiple contributory factors in hairdressers with contact dermatitis. Sixty-five per cent of participants in this study were found to have two or more diagnoses. This finding has significant implications for the management of hairdressers with contact dermatitis, because an improvement in symptoms is unlikely to occur unless all diagnoses, including irritant contact dermatitis and latex protein allergy, are identified and appropriately treated.

In summary, 96% of hairdressers assessed in our clinic were found to have occupational skin disease, and multifactorial OCD was common. In our population, allergic contact dermatitis is more significant than irritant contact dermatitis, particularly in hairdressing apprentices. The involvement of more than one skin area is suggestive of allergic contact dermatitis, although clinical examination is unreliable in differentiating allergic from irritant contact dermatitis, and patch testing is therefore recommended for all hairdressers presenting with dermatitis (41). Important hairdressing allergens include ammonium persulfate, *p*-phenylenediamine, toluene-2,5-diamine, and glycerol monothioglycolate. Exposure to these chemicals should be minimized in all hairdressers through improved education, avoidance, and the use of appropriate skin protection. In addition, preventive measures and legislative changes, such as those implemented in Germany, with the elimination of powdered disposable latex gloves and glycerol monothioglycolate, are effective in reducing rates of OCD, and should be pursued.

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