

lincomycin was negative, false-negative patch tests readily occur,⁵ and so an OCT was additionally performed, allowing us to demonstrate the effective tolerance to lincomycin. The patient has thus been recommended to avoid clindamycin, but not lincomycin. In summary, we have presented a case of FDE due to clindamycin, without cross-reactivity to lincomycin, and we confirm the clear value of in situ patch tests in this setting, as opposed to other skin tests. Furthermore, we highlighted that in non-severe drug eruptions negative skin tests need to be completed by an OCT to confirm, or refute, the existence of a drug hypersensitivity.

1 | AUTHOR CONTRIBUTIONS

Laura Romero-Sánchez: Investigation; writing – original draft; writing – review and editing; conceptualization; validation; visualization; methodology. **Paula Méndez-Brea:** Conceptualization; writing – original draft; writing – review and editing; investigation; visualization; validation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Allergic contact cheilitis in Melbourne, Australia

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Cheilitis is a relatively common inflammatory condition, and its many causes include endogenous, irritant, and allergic contact cheilitis (ACC). The main reported causes of ACC are fragrances, flavouring agents, and preservatives,¹ lanolin alcohol,² benzophenone 3,³ and colophonium.^{2,4} We used this information and the results of the current retrospective analysis to update our in-house cheilitis patch test series.

1 | PATIENTS AND METHODS

This retrospective study included patients with cheilitis who underwent patch testing between January 2012 and June 2017 at the Skin Health Institute, Melbourne, Australia. They were tested at least with the Australian Baseline Series and our former cheilitis series

(Table S1). Most of the allergens were from Chemotechnique Diagnostics and SmartPractice. Sodium fluoride and spearmint were compounded by a pharmacist (Clarendon Pharmacy). The spearmint essential oil was obtained from the Australian Essential Oil Company, Coraki New South Wales, Australia, and diluted to 5% in white soft paraffin. Spices (coriander, nutmeg, ginger powder) were obtained from a local supplier and diluted according to the literature.⁵ Sodium fluoride was tested at 0.5% aqua.⁶ Testing was performed using Allergeaze patch test chambers (SmartPractice) and allergens were applied for 48 h. Reactions were recorded on Days 2 and 4 according to ESCD guidelines. All participants provided written consent for patch testing. Photopatch testing was performed for all suspected sunscreen reactions. The diagnosis of ACC was based on the clinical presentation of an eczematous rash on the lips, at least one positive patch test, and a history of exposure to the hapten(s) suggesting a relevant reaction; however, follow-up was not always performed.

2 | RESULTS

Of the 2427 patients patch tested, 141 (112 females, 29 males) (5.8%) were diagnosed with cheilitis, and 61 (43.3% of those with cheilitis) were diagnosed with ACC. The relevant haptens causing ACC are listed in Table 1. While fragrances, lanolin and nickel were often considered relevant, important additional relevant sensitizers included dodecyl gallate, spices, and mint derivatives (peppermint

TABLE 1 Relevant allergens in allergic contact cheilitis (ACC)

Allergens	Total	%
<i>Myroxylon pereirae</i> resin (25% pet.)	16	26.2
Fragrance mix I (8% pet.)	10	16.4
Amerchol L 101 (50% pet.)	9	14.8
Nickel sulphate hexahydrate (5% pet.)	8	13.1
Fragrance mix II (14% pet.)	7	11.5
Dodecyl gallate (0.25% pet.)	6	9.8
Nutmeg (25% pet.) ^a	6	9.8
Peppermint oil (2% pet.)	5	8.2
Ginger powder (5% pet.) ^a	4	6.6
Palladium chloride (2% pet.)	4	6.6
Sodium fluoride (0.5% aq) ^b	4	6.6
Spearmint (5% pet.) ^b	4	6.6
BHA (Butylated hydroxyanisole) (2% pet.)	3	4.9
Cobalt chloride hexahydrate (1% pet.)	3	4.9
Coriander (25% pet.) ^a	3	4.9
Hydroxyisohexyl 3 cyclohexene carboxaldehyde (Lyril) (5% pet.)	3	4.9
Methylisothiazolinone (0.2% aq)	3	4.9
Hydroperoxides of linalool (1% pet.)	2	3.3

TABLE 1 (Continued)

Allergens	Total	%
Lanolin alcohol (wool alcohol) (30% pet.)	2	3.3
Lemongrass oil (2% pet.) ^c	2	3.3
Menthol (2% pet.)	2	3.3
Methyl methacrylate (2% pet.)	2	3.3
Sodium benzoate (5% pet.)	2	3.3
2-Hydroxyethyl methacrylate (2% pet.)	1	1.6
4-Methylbenzylidene camphor (Eusloex 6300) (10% pet.)	1	1.6
Trans-anethole (5% pet.)	1	1.6
Benzoic acid (5% pet.)	1	1.6
Benzophenone-3 (10% pet.)	1	1.6
Carba mix (3% pet.)	1	1.6
Cinnamon oil (0.5% pet.)	1	1.6
Citral (2% pet.)	1	1.6
Diallyl disulphide (1% pet.)	1	1.6
Epoxy resin (bisphenol A) (1% pet.)	1	1.6
Ethylhexyl methoxycinnamate (10% pet.)	1	1.6
Formaldehyde (1% aq)	1	1.6
Gold sodium thiosulfate (0.5% pet.)	1	1.6
Hydroabietyl alcohol (Abitol) (10% pet.)	1	1.6
Hydroperoxides of limonene (0.3% pet.)	1	1.6
Imidazolidinylurea (2% pet.)	1	1.6
Isoeugenol (2% pet.)	1	1.6
Lavender absolute (<i>Lavandula angustifolia</i>) (2% pet.)	1	1.6
Lemon oil (2% pet.) ^c	1	1.6
Paraben mix (12% pet.)	1	1.6
Ylang-ylang oil (5% pet.)	1	1.6
Zinc chloride (1% pet.)	1	1.6
Carvone (R and L) (5% pet.)	0	0.0

Note: Underlined allergens not included in Australian Baseline Series.

Abbreviation: aq, aqueous.

^aAllergens prepared in-house.

^bAllergens made up by a compounding pharmacy (Clarendon Pharmacy).

^cAllergens obtained from SmartPractice. The other allergens are obtained from Chemotechnique Diagnostics.

oil, menthol, and spearmint), and sodium fluoride. Skincare products, particularly lip balms and toothpaste, were the leading sources of these haptens.

3 | DISCUSSION

Over 40% of those with cheilitis were diagnosed with ACC, which is higher than in previous studies.^{3,7} *Myroxylon pereirae* resin was the most common relevant hapten in our study, and is reported to be the second most common in the United States and Western Europe,^{1,2} but is less common in Asia.⁴ Sources were cosmetics

(including dental care products) and food flavourings.² A popular lip moisturizer in Australia, Lucas Papaw Ointment (Lucas Papaw Remedies), is made from papaya extract and contains a trace of *M. pereirae* resin. We have previously reported this as causing ACC.⁸

In contrast to previous Australian studies of cheilitis, where benzophenone-3 was a predominant cause of ACC,^{3,7} we found fragrances and related allergens, lanolin, nickel, dodecyl gallate, mint derivatives, and spices to be most important. We found comparatively high rates of relevant reactions to peppermint oil (5/61) and spearmint (4/61) in contrast to previous studies^{1,2,4} although interestingly not the major ingredient carvone. Sources included toothpastes, electronic cigarettes and peppermint tea. Mint derivatives have also been reported to cause oral lichenoid lesions⁹ and burning mouth syndrome.¹⁰ Dodecyl gallate^{1,2} and the antioxidant BHA¹¹ have been reported to cause ACC previously.

Sodium fluoride is an irritant and has rarely been reported to cause allergy. There has been only one case reported causing severe contact urticaria.¹² Nevertheless we observed four relevant reactions to sodium fluoride. As diluted samples of these patients' toothpastes did not always react on testing, it is possible that some of the reactions were irritant. However, two of four patients reported that avoidance of fluoride-containing toothpastes resulted in improvement. Subsequently, stannous fluoride has been reported as an allergen, and preparations of tin (e.g., 50% pet.) have been recommended for patch testing.¹³

While these relevant haptens reflect exposure in our population, this information may be useful for dermatologists' patch testing elsewhere.

AUTHOR CONTRIBUTIONS

Hiromi Mizutani: Conceptualization (equal); data curation (lead); formal analysis (lead); methodology (equal); writing – original draft (lead). **Claire Felmingham:** Conceptualization (supporting); data curation (supporting); methodology (equal); writing – original draft (supporting). **Amanda Palmer:** Data curation (lead); methodology (supporting); project administration (supporting); resources (equal); supervision (supporting). **Bruce Tate:** Conceptualization (supporting); project administration (equal); resources (equal); supervision (equal); writing – review and editing (supporting). **Mei M. Tam:** Conceptualization (equal); methodology (equal); project administration (equal); resources (equal); supervision (equal); writing – review and editing (equal). **Rosemary Nixon:** Conceptualization (equal); methodology (equal); project administration (equal); resources (equal); supervision (lead); writing – review and editing (equal).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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