STUDY

Use of Consumer Product Ingredients for Patch Testing

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Background: Patch testing for suspected sensitivity to cosmetics and other personal care products is usually done by testing with nonirritating products "as is" and by panels of antigens likely to contain causative ingredients. Most allergic reactions are reportedly due to sensitivity to either fragrances or preservatives. Although most preservatives found in patients' products are available for patch testing, only a small number of fragrance ingredients are available, and fragrance components are seldom labeled. Most personal care products contain many other ingredients, and unless the patient reacts to the whole product and the ingredients are obtained from the manufacturer, most of these are seldom tested.

Objective: To investigate the importance of testing with these other ingredients.

Methods: Investigators reviewed patch-test records of patients who presented with eruptions compatible with the use of their personal care products and who were tested with available ingredients that were listed on the labels of products they were using. This allowed testing with many ingredients in products that are too irritant for "as is" testing. Some of the results included those of persons who were tested in other series, so these were separated.

Results: Of patch tests with 52 cosmetic ingredients also tested in other series, 3.4% produced at least one + or greater reaction. Of those antigens tested only when present in products used by the patient, 55 of the 121 ingredients produced at least one + reaction, and about 3.6% of the test results were positive.

Conclusions: Adding ingredients found in the patient's personal care products to patch tests done on those compatible with exposure increases the positive yield in patch testing, and the number of positive results is likely to increase as more ingredients are available for testing.

ALLERGY TO COSMETICS is said usually to be caused by preservatives and fragrances.[1,2] Allergy caused by fragrances actually may be more common than is reported because we do not test with most fragrance ingredients, relying on a small panel of mixes and markers such as balsam of Peru and fragrance mix but leaving out thousands of fragrance ingredients. However, personal care products also contain numerous other ingredients that are seldom tested. The Cosmetic, Toiletry, and Fragrance Association (CTFA) dictionary lists more than 12,000 ingredients,[3] and that list seems to be growing with each new edition of the dictionary.

For testing cosmetic ingredients, some have used a tray of ingredients, but Rietschel found one such panel to be of relatively little value[4] although not everyone agrees.[5] Testing in this series has been done with available ingredients of products used by the patients, in the concentrations and vehicles (mostly as published by deGroot[6]) shown in Tables 1 to 3. This article concerns the experience of testing with such ingredients. Fragrances listed on the label are included, but commonly used preservatives were not included because test results for these have been published many times.

Reprints not available.

Materials and Methods

New patients in a practice limited to contact dermatitis and eczema were asked to bring all of their personal care products, and the labels were read for ingredients. The patients were patch-tested with a standard diagnostic series and with as many ingredients of their products (to which there was possible relevant exposure) as were available. Records of both positive and negative patch-test results were stored in a computer file. A review of the patch-test results from cosmetic ingredients was done from computer records. Fragrances, unless components were specified on labels, and commonly used preservatives were omitted from testing. Drug and cosmetic (D&C) and food, drug, and cosmetic (FD&C) dyes were not included because results from testing with these have been previously published.[7] Testing was done only with ingredients of products the patients had been using, except for the items marked with asterisks in Tables 1 to 3. These lists include some 105 botanicals or essential oils of plant origin.

Results

Results are shown in Tables 1 to 3. Of the cosmetic ingredients marked with an asterisk, 3.4% produced + or

Table 1. Reactions to the 20 Most Commonly Tested Antigens

Antigen	*Total Patients Tested*	+/−	+	++	+++
Propylene glycol 5% pet*	2,651	35	32	9	—
Cocamidopropyl betaine 1% aq*	1,765	87	138	26	1
Triclosan (Irgasan DP 300) 2% pet*	1,737	33	36	10	1
4-Chloro-3-xylenol (PCMX) 1% pet*	986	14	16	8	4
2,6-ditert-Butyl-4-cresol (BHT) 2% pet*	814	15	3	2	—
2-tert-Butyl-4-methoxyphenol (BHA) 2% pet*	750	17	9	2	1
Triethanolamine 2% pet*	486	29	17	9	1
Aloe vera gel (as is)	380	14	11	—	—
Vitamin E oil (as is)	352	11	8	1	—
2-Hydroxy-4-methoxybenzophenone 10% pet*	291	3	3	2	—
Roman chamomile (*Anthemis nobilis*) 1% pet*	271	8	5	3	—
4-Chloro-3-cresol (PCMC) 1% pet*	267	9	7	1	—
Benzyl alcohol 1% pet*	256	5	6	2	—
Rosemary leaves (as is [p])*	234	21	18	5	—
Chlorhexidine digluconate 0.5% aq*	196	4	4	2	—
DL-Panthenol (50% solution) 5% pet	192	5	1	1	—
Peppermint 2% pet*	160	7	5	1	1
Sweet almond oil 4% pet	155	6	2	—	—
Polyglycol 300 (as is)	137	—	1	—	—
Phenyl salicylate (salol) 1% pet*	134	1	1	—	—

alc = alcohol; aq = aqueous; as is = undiluted; as is [p] = undiluted antigen with sufficient petrolatum for binding; pet = petrolatum.
*Denotes results from patients tested to this antigen in this and other series.

greater reactions. Of those 121 antigens not marked with an asterisk, 55 produced at least one + reaction, and about 3.6% of the test results were positive. Of some 105 botanicals and essential oils of plant origin, 52 produced at least one + reaction.

Discussion

Patients in this series were tested with available ingredients of personal care products that they were using. Many of these ingredients were in other test panels, so the reactions to these were not necessarily produced by the personal care products. However, for most ingredients (those listed without an asterisk in Table 1), testing was done only with those listed on the labels of products brought in by the patient. This made a positive test result at least possibly relevant and showed the patient which ingredients to avoid. The percentages of reactions to those ingredients listed with and without asterisks are similar (3.4% and 3.6%, respectively). This way of testing produced a number of reactions that might have been missed by testing only with one or more test panels and nonirritating whole products; it also allowed testing with many ingredients in products too irritant to test "as is."

Persons suspected of having allergic contact dermatitis from consumer products are often tested with a screening series of antigens[4,5,8] to look for possible sources of that allergy; this may be a "standard" series, a cosmetic series, or one of each. Most preservatives are included in a standard diagnostic series, but many of the 12,000 potential ingredients[3] are not available and therefore are not tested.[4,5] Testing with whole products is a practical method for assessing response to nonirritating items, but it may miss some reactions because of the low concentration, requiring use on damaged skin or repeated application over time for reactions to appear.[9] Testing with ingredients furnished by manufacturers can be most helpful if results are positive, but the concentrations furnished may not always be optimum, and there is a necessary delay in the work-up.

Many reported reactions to consumer products are caused by antigens that are not normally tested. Such antigens include castor oil[10] and ricinoleates[11,12]; polyvinylpyrrolidone (PVP)/eicosene copolymer[13]; PVP/triacontene copolymer[14]; polyoxyethylene lauryl ether[15]; *Melaleuca*[16,17]; hops[18]; medium-chain triglycerides[19]; hydrophilized ceramide[20]; ethylhexylglycerin[21]; mountain tobacco, dandelion, yarrow, feverfew, propolis, lichen acids, and

Table 2. Other Reactions to Cosmetic Ingredients

Antigen	*Total Patients Tested*	+/−	+	++	+++
2,6-ditert-Butyl-4-cresol (BHT) 2% pet*	814	15	3	2	—
2-Hydroxy-4-methoxybenzophenone 10% pet*	291	3	3	2	—
2-tert-Butyl-4-methoxyphenol (BHA) 2% pet*	750	17	9	2	1
4-Chloro-3-cresol (PCMC) 1% pet*	267	9	7	1	—
4-Chloro-3-xylenol (PCMX) 1% pet*	986	14	16	8	4
Abitol (Eastman Chemical Company, Kingsport, TN) 10% pet*	48	3	—	—	1
Allantoin powder 5% pet	76	2	1	1	—
Almond oil (as is)	7	—	1	—	—
Aloe vera gel (as is)	380	14	11	—	—
American ginseng (as is [p])	17	—	1	—	—
Anise seed (as is [p])	15	2	3	—	—
Basil leaves (as is [p])	14	—	1	—	—
Beeswax 30% pet*	128	1	2	—	—
Benzyl alcohol 1% pet*	256	5	6	2	—
Benzyl salicylate 2% pet*	69	1	1	—	—
Beta carotene 5% pet	6	1	—	—	—
Borage powder (as is [p])	4	—	—	1	—
Boric acid 3% aq	12	1	—	—	—
Butylene glycol 6% aq*	6	1	—	—	—
Calendula ointment (as is)	53	7	—	—	—
Candellila wax 4% pet	9	1	—	—	—
Caprylic/capric triglyceride 1% pet	52	1	4	—	—
Caraway seed (as is [p])	1	1	—	—	—
Cardamom (hulled), dry (as is [p])	10	1	—	—	—
Castor oil (as is)	93	3	—	—	—
Celery seed, dry (as is [p])	44	—	1	1	—
Cetyl alcohol 5% pet	106	—	1	—	—
Chamomile (*Matricaria recutita*) 4% pet	48	2	—	—	—
Chamomilla romana (*Anthemis nobilis*) 1% pet*	271	8	5	3	—
Chlorhexidine digluconate 0.5% aq*	196	4	4	2	—
Chloroacetamide 0.2% pet*	110	1	—	—	—
Cloves (as is [p])	26	2	—	—	—
Cocamidopropyl betaine 1% aq*	1,765	87	138	26	1
Cocoa butter (as is [p])	64	2	3	1	—
Coconut wax (as is)	81	1	2	—	—
Comfrey root, dry (as is [p])	25	—	1	—	—
Coriander powder (as is [p])	8	1	1	—	—
Dimethylaminopropylamine (DMP-30) 1% aq*	8	1	—	—	—
Dipentene (d-limonene) 1% pet*	129	1	2	2	—
DL-Panthenol (50% solution) 5% pet	192	5	1	1	—
Dodecyl gallate 0.25% pet*	37	2	1	—	—
Echinacea herb, dry (as is [p])	18	2	2	—	—
Elderberry, dry (as is [p])	14	1	3	1	—
Eucalyptus oil 2% pet	96	2	2	1	—
Evening primrose 1% pet	11	1	—	—	—
Fennel (as is [p])	7	2	1	—	—
Flax seed, dry (as is [p])	116	—	5	2	2
Gardenia 2% pet	3	—	2	—	—
Geranium bourbon 10% pet*	44	2	—	—	—

continued

Table 2. *Continued*

Antigen	*Total Patients Tested*	+/−	+	++	+++
Ginger, ground (as is [p])	18	1	7	—	—
Ginkgo powder (as is [p])	10	1	1	1	—
Goldenseal leaf, dry (as is [p])	3	—	1	—	—
Grapefruit 10% pet	19	1	—	—	—
Grapeseed oil 5% pet	31	—	1	—	—
Green tea, granules (as is [p])	33	3	3	—	—
Hops powder (as is [p])	29	2	3	1	—
Iron oxide 0.8% pet	21	1	2	—	—
Isopropyl myristate 20% pet	113	2	—	—	—
Isopropyl palmitate in mineral oil	39	—	1	—	—
Jasmine absolute, some at 10%, some at 2% pet*	51	—	—	1	—
Jojoba 20% aq (olive oil)	71	1	—	—	—
Lecithin powder 5% pet	73	6	1	1	—
Lemongrass 2% pet	14	1	1	—	—
Lemon oil 2% pet	48	1	—	—	—
Linden powder (as is [p])	5	1	—	—	—
Macadamia nut oil 5% pet	64	3	1	—	—
Mace (as is [p])	13	4	1	—	—
Myrrh oil 8% pet	11	1	—	—	—
Nettles 5% aq	38	3	4	—	—
Nutmeg (as is [p])	15	2	1	—	—
Oatmeal flakes (as is [p])	131	4	8	—	—
Octyl gallate 0.25% pet*	54	5	5	1	—
Octyl salicylate 50% pet	33	3	—	—	—
Oleamidopropyl dimethylamine 0.4% pet*	25	1	—	—	—
Olive oil (as is)	35	2	—	—	—
Orange 2% pet	55	—	2	—	—
Oregano leaf (as is [p])	13	2	—	—	—
Paprika (as is [p])	15	2	1	—	—
Passion flower powder (as is [p])	8	1	—	—	—
Patchouli, cut dry (as is [p])	8	2	—	—	—
Peppermint 2% pet*	160	7	5	1	1
Phenyl salicylate (salol) 1% pet*	134	1	1	—	—
Polyglycol 300 (as is)	137	3	1	—	—
Polyoxyethylene sorbitan oleate 5% pet	29	2	—	—	—
Propyl gallate 1% pet*	56	—	—	2	—
Propylene glycol 5% pet*	2,651	35	32	9	—
Red iron oxide 0.8% pet	3	—	1	—	—
Rosemary leaves (as is [p])*	234	21	18	5	—
Safflower powder (as is [p])	23	1	5	1	—
Sage (as is [p])	77	5	3	—	—
Sesame oil (as is)	27	1	—	—	—
Sesame seed (as is [p])	10	1	—	—	—
Shea butter (as is)	38	2	1	—	—
Sodium-2-pyridinethiol-1-oxide (Na-omadine) 0.1% aq*	69	1	1	—	—
Sorbic acid 2% pet*	93	3	—	—	—
Sorbitan monooleate 2% pet	79	1	—	—	—
Sorbitan monostearate 2% pet	20	1	—	—	—
Sorbitol 10% aq	104	3	3	—	—

continued

Table 2. *Continued*

Antigen	*Total Patients Tested*	+/−	+	++	+++
Soy protein powder (as is [p])	98	4	4	—	—
Spearmint 2% pet*	111	4	3	—	1
Stearyl alcohol 30% pet	36	1	—	—	—
Sweet almond oil 4% pet	155	6	2	—	—
Thyme (as is [p])	24	3	2	—	—
Vanilla extract (as is)*	32	4	2	—	—
Vitamin E oil (as is)	352	11	8	1	—
Vitamin A palmitate/retinyl palmitate (as is)	95	2	3	—	—
Vitamin B_3 1% aq	2	1	—	—	—
Watercress flakes (as is [p])	6	—	2	—	—
Wheat germ oil 20% pet	108	6	1	1	—
Witch hazel (as is)	24	1	1	—	—
Xanthan gum powder 10% pet	103	4	9	—	—
Yucca 1% pet	8	2	1	—	—

alc = alcohol; aq = aqueous; as is = undiluted; as is [p] = undiluted antigen with sufficient petrolatum for binding; pet = petrolatum.
*Denotes results from patients tested to this antigen in this and other series.

alpha-methyl-gamma-butyrolactone[17]; cocamidopropyl hydroxysultaine[22]; wheat[23]; soy[24]; maleated soy[25]; tetrahydroxypropyl ethylenediamine[26]; eucalyptol[27]; 1,3-butylene glycol[28]; triethanolamine[29,30]; benzophenone-3[12,31]; benzophenone-4[31]; benzophenone-10[12]; menthol[12]; L-carvone[12]; glyceryl monoisostearate monomyristate[32]; sodium dodecyl phosphate[33]; vitamin C[34]; tocopherol acetate[35]; laureth 4[36]; laureth 9; polyquaternium-7[37]; methoxy polyethylene glycol (PEG) 22/dodecyl glycol modified colophony derivatives[38]; peppermint oil[38]; lauryl alcohol[38]; tangerine[39]; shellac[40]; yellow carnauba wax[41]; coathylene,[41] phthalic anhydride/trimellitic anhydride/glycols copolymer[42]; sodium myristoyl sarcosinate/sodium myristoate[43]; cetearyl isononanoate[44]; and diisostearyl malate.[45]

One much overlooked category is the fatty alcohols and their esters. Laube and colleagues[19] reported two persons who were allergic to dicapryl maleate, a product of caprylyl alcohol and maleic acid. There may be other cosmetic ingredients causing reactions, but such ingredients are seldom tested.

Botanicals represent a special category of cosmetic ingredients that have the potential to cause allergy[46] and that have recently become important in the work-up of persons with suspected allergy to consumer products.[47] This category includes materials of plant origin and (in this study) essential oils (fragrances) of plant origin. In this series, about half of the 105 plant materials tested produced at least one reaction that was + or greater. Simpson and colleagues[48] found that almost 50% of patients with contact dermatitis had at least one positive reaction on a botanical screening series, compared with a prevalence of 3.4% in the control population. They[48] and others[16] have found tea tree oil to be a common cause of reactions, but the importance of tea tree oil as a reactor in the United States[49] and Europe[50] has been questioned. In this series, rosemary seemed to be a common reactor.

The labeling of botanical ingredients can be a source of confusion. The names of most can be found in the CTFA dictionary, but the use of common names in labeling can be misleading, sometimes necessitating testing with numerous materials that have the same common name. For example, if a label provides only the name "chamomile," one must test with both Roman and *Matricaria* chamomile. When the botanical name but no other information is provided, a helpful source is *Hortus Third*,[51] which provides a thumbnail outline of each species in the genus and common names in a separate index.

The concentration of botanicals is often low, suggesting a low risk of sensitization. However, there are numerous reports of reactions,[10–12,16–18,23–25,27,39,52] and among 215 persons with eyelid dermatitis, there were 14 reactions to 13 botanicals.[53] Moreover, in a prospective study,[48] 48% of patients with a history of exposure had relevant positive reactions to a panel of botanicals. A number of putative medicinal uses for botanicals is discussed by Draelos.[54] Reactions to botanicals were reviewed recently,[55] but not all of those cited were found in consumer products.

Since not every ingredient is available for testing, the number of product ingredients used in this series may

Table 3. Cosmetic Ingredients Producing No Reactions

Antigen	*Total Patients Tested*
Apricot kernel 10% aq	15
Arnica montana 0.5% pet*	53
Avocado oil (as is)	41
Bayberry powder (as is [p])	1
Bergamot 2% pet	2
Biotin 1% aq	3
Black iron oxide 2% pet	11
Canola oil (as is)	4
Carrot seed oil 4% pet	6
Cinnamon ground (as is [p])	19
Comfrey *Calendula* (as is)	2
Corn oil 30% pet	34
Cumin (as is [p])	1
Dill (as is [p])	15
Dimethicone copolyol 10% pet	2
Elder flower, dry (as is [p])	5
Hazelnut 30% pet	2
Honeysuckle, dry (as is [p])	7
Horsetail 10% alc	14
Hyssop 4% pet	3
Juniper 2% pet	4
Kaolin 5% aq	1
Kelp powder (as is [p])	4
Licorice powder (as is [p])	2
Magnolia oil 2% pet	1
Mandarin orange oil 8% pet	8
Marshmallow root powder (as is [p])	5
Meadowsweet, dry (as is [p])	1
Mineral oil (as is)	22
Neroli, 5th pressing 2% pet	2
Papaya leaf (as is [p])	12
Phenylmercuric acetate 0.01% pet*	28
Red clover powder (as is [p])	1
Red raspberry leaf powder (as is [p])	1
Rose absolute 2% pet	8
Rose hip oil 2% pet	9
Sorbitan sesquioleate 20% pet*	43
Tea tree oil (*Melaleuca*) 1% alc	1
Tea tree oil (*Melaleuca*) 1% pet	6
Vitamin B_2 5% pet	2
Whole bay leaves (as is [p])	8
Wild cherry oil 2% pet	2
Yellow iron oxide 0.8% pet	10
Ylang ylang oil 2% pet*	16

alc = alcohol; aq = aqueous; as is = undiluted; as is [p] = undiluted antigen with sufficient petrolatum for binding; pet = petrolatum.
*Denotes results from patients tested to this antigen in this and other series.

well be incomplete. However, as most patients were tested only with ingredients of products to which they were exposed, those responses are possibly or probably relevant. Many were only + reactions, but the items causing those reactions probably should be avoided until the patient is clear and a use test can be performed, because mild and subthreshold reactions are additive.[56]

References

1. Marks JG, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group: patch test results, 1996-1998. J Am Acad Dermatol 1998;38:911–8.
2. Wolf R, Wolf D, Tuzun B, Tuzun Y. Contact dermatitis to cosmetics. Clin Dermatol 2001;19:502–15.
3. Wenninger JA, McEwen GN. International cosmetic ingredient dictionary and handbook. Vol. 1–3. 9th ed. Washington (DC): Cosmetic, Toiletry, and Fragrance Association; 2001.
4. Rietschel RL. Experience with supplemental allergens in the diagnosis of contact dermatitis. Cutis 2000;65:27–30.
5. Trattner A, Farchi Y, David M. Cosmetics patch tests: first report from Israel. Contact Dermatitis 2002;47:180–1.
6. deGroot AC. Patch testing. Amsterdam: Elsevier, 1994.
7. Guin JD. Patch testing to FD&C and D&C dyes. Contact Dermatitis 2003;49:217–8.
8. Trattner A, Hodak E, David M. Screening patch tests for pigmented contact dermatitis in Israel. Contact Dermatitis 1999;40:155–7.
9. deGroot AC. Cosmetics. In: Guin JD, editor. Practical contact dermatitis: a handbook for the practitioner. New York: McGraw-Hill; 1995. p. 333–53.
10. le Coz CJ, Ball C. Recurrent allergic contact dermatitis and cheilitis due to castor oil. Contact Dermatitis 2000;42:114–5.
11. Magerl A, Heiss R, Frosch PJ. Allergic contact dermatitis from zinc ricinoleate in a deodorant and glyceryl ricinoleate in a lipstick. Contact Dermatitis 2001;44:119–21.
12. Lim SW, Goh CL. Epidemiology of eczematous cheilitis at a tertiary dermatological referral centre in Singapore. Contact Dermatitis 2000;43:322–6.
13. le Coz CJ, Lefebvre C, Ludmann F, Grosshans E. Polyvinylpyrrolidone (PVP)/eicosene copolymer: an emerging cosmetic allergen. Contact Dermatitis 2000;43:61–2.
14. Stone N, Varma S, Hughes TM, Stone NM. Allergic contact dermatitis from polyvinylpyrrolidone (PVP)/1-triacontene copolymer in a sunscreen. Contact Dermatitis 2002;47:49.
15. Kimura M, Kawada A. Follicular contact dermatitis due to polyoxyethylene laurylether. J Am Acad Dermatol 2000;42:879–80.
16. Fritz TM, Burg G, Krasovec M. [Allergic contact dermatitis to cosmetics containing *Melaleuca alternifolia* (tea tree oil)]. Ann Dermatol Venereol 2001;128:123–6.
17. Thomson KF, Wilkinson SM. Allergic contact dermatitis to plant extracts in patients with cosmetic dermatitis. Br J Dermatol 2000; 142:84–8.
18. Spiewak R, Dutkiewicz J. Occupational airborne and hand dermatitis to hop (*Humulus lupulus*) with non-occupational relapses. Ann Agric Environ Med 2002;9:249–52.
19. Laube S, Davies MG, Prais L, Foulds IS. Allergic contact dermatitis from medium-chain triglycerides in a moisturizing lotion. Contact Dermatitis 2002;47:171.
20. Yajima J. Allergic contact dermatitis due to hydrophilized ceramide. Contact Dermatitis 2002;47:245.

21. Linsen G, Goossens A. Allergic contact dermatitis from ethylhexylglycerin. Contact Dermatitis 2002;47:169.
22. Guin JD. Reaction to cocamidopropyl hydroxysultaine, an amphoteric surfactant and conditioner. Contact Dermatitis 2000;42:284.
23. Sanchez-Perez J, Sanz T, Garcia-Diez A. Allergic contact dermatitis from hydrolyzed wheat protein in cosmetic cream. Contact Dermatitis 2000;42:360.
24. Shaffrali FC, Gawkrodger DJ. Contact dermatitis from soybean extract in a cosmetic cream. Contact Dermatitis 2001;44:51–2.
25. Le Coz CJ, Lefebvre C. Contact dermatitis from maleated soybean oil: last gasps of an expiring cosmetic allergen. Contact Dermatitis 2000;43:118–9.
26. Kirkup ME, Sansom JE. Contact sensitivity to tetrahydroxypropyl ethylenediamine in a sunscreen, without cross-sensitivity to ethylenediamine. Contact Dermatitis 2000;43:121–2.
27. Vilaplana J, Romaguera C. Allergic contact dermatitis due to eucalyptol in an anti-inflammatory cream. Contact Dermatitis 2000;43:118.
28. Diegenant C, Constandt L, Goossens A. Allergic contact dermatitis due to 1,3-butylene glycol. Contact Dermatitis 2000;43:234–5.
29. Hannuksela M, Kousa M, Pirila V. Contact sensitivity to emulsifiers. Contact Dermatitis 1976;2:201–4.
30. Chu CY, Sun CC. Allergic contact dermatitis from triethanolamine in a sunscreen. Contact Dermatitis 2001;44:41–2.
31. Guin JD. Eyelid dermatitis from benzophenone used in nail enhancement. Contact Dermatitis 2000;43:308–9.
32. Asai M, Kawada A, Aragane Y, Tezuka T. Allergic contact cheilitis due to glyceryl monoisostearate monomyristate in a lipstick. Contact Dermatitis 2001;45:173.
33. Lomholt H, Rastogi SC, Andersen KE. Allergic contact dermatitis from sodium dihydroxycetyl phosphate, a new cosmetic allergen? Contact Dermatitis 2001;45:143–5.
34. Belhadjali H, Giordano-Labadie F, Bazex J. Contact dermatitis from vitamin C in a cosmetic anti-aging cream. Contact Dermatitis 2001;45:317.
35. Matsumura T, Nakada T, Ligima M. Widespread contact dermatitis from tocopherol acetate. Contact Dermatitis 2004;51:211–2.
36. Svensson A. Allergic contact dermatitis to laureth-4. Contact Dermatitis 1988;18:113–4.
37. Gallo R, Basso M, Voltolini S, Guarrera M. Allergic contact dermatitis from laureth-9 and polyquaternium-7 in a skin-care product. Contact Dermatitis 2001;45:356–7.
38. Goossens A, Milpied-Homsi B, Le Coz C. An epidemic of allergic contact dermatitis from epilating products. Contact Dermatitis 2001;45:360.
39. Vilaplana J, Romaguera C. Contact dermatitis from the essential oil of tangerine in fragrance. Contact Dermatitis 2002;46:108.
40. Le Coz CJ, Leclere JM, Arnoult E, et al. Allergic contact dermatitis from shellac in mascara. Contact Dermatitis 2002;46:149–52.
41. Chowdhury MM. Allergic contact dermatitis from prime yellow carnauba wax and coathylene in mascara. Contact Dermatitis 2002;46:244.
42. Moffitt DL, Sansom JE. Allergic contact dermatitis from phthalic anhydride/trimellitic anhydride/glycols copolymer in nail varnish. Contact Dermatitis 2002;46:236.
43. Malanin KE. Allergic contact dermatitis caused by a mixture of sodium myristoyl sarcosinate and sodium myristoate in a cosmetic product. Contact Dermatitis 2002;47:50.
44. Le Coz CJ, Bressieux A. Allergic contact dermatitis from cetearyl isononanoate. Contact Dermatitis 2003;48:343.
45. Guin JD. Allergic contact cheilitis from di-isostearyl malate in lipstick. Contact Dermatitis 2001;44:375.
46. Jerschow E, Hostynek JJ, Maibach HI. Allergic contact dermatitis elicitation thresholds of potent allergens in humans. Food Chem Toxicol 2001;39:1095–108.
47. Ortiz KJ, Yiannias JA. Contact dermatitis to cosmetics, fragrances, and botanicals. Dermatol Ther 2004;17:264–71.
48. Simpson EL, Law SV, Storrs FJ. Prevalence of botanical extract allergy in patients with contact dermatitis. Dermatitis 2004;15:67–72.
49. Crawford GH, Sciacca JR, James WD. Tea tree oil: cutaneous effects of the extracted oil of *Melaleuca alternifolia*. Dermatitis 2004;15:59–66.
50. Veien NK, Rosner K, Skovgaard GL. Is tea tree oil an important contact allergen? Contact Dermatitis 2004;50:378–9.
51. Staff of the LH Bailey Hortorium. Hortus third. New York: Macmillan; 1976.
52. Wilkinson SM, Hausen BM, Beck MH. Allergic contact dermatitis from plant extracts in a cosmetic. Contact Dermatitis 1995;33:58–9.
53. Guin JD. Eyelid dermatitis: a report of 215 patients. Contact Dermatitis 2004;50:87–90.
54. Draelos Z. Botanicals as topical agents. Clin Dermatol 2001;19:474–7.
55. Kiken DA, Cohen DE. Contact dermatitis to botanical extracts. Am J Contact Dermat 2002;13:148–52.
56. McLelland J, Shuster S. Contact dermatitis with negative patch tests: the additive effect of allergens in combination. Br J Dermatol 1990;122:623–30.