

Contact Allergy to Surfactants in a Hypoallergenic Liquid Cleanser

Jamie L. Hanson, BS*†‡ and Erin M. Warshaw, MD†‡

Surfactants are a relatively rare cause of allergic contact dermatitis (ACD) and testing patients to personal care products containing these ingredients has historically been difficult given their irritant properties. Using the semiopen technique, we were able to identify ACD to a hypoallergenic liquid cleanser in 2 patients who presented to our patch test clinic only months apart. Additional patch testing to individual ingredients led to subsequent identification of 3 novel surfactant allergens (sodium lauroyl sarcosinate, isostearamidopropyl morpholine lactate, and disodium lauroamphodiacetate). Only one of these allergens, sodium lauroyl sarcosinate, has previously been reported as a cause of ACD.

BACKGROUND

Surfactants are chemicals that reduce the surface tension of the skin to remove debris such as dirt, oil, and sebum. However, because of their ability to interact with proteins and lipids of the stratum corneum, surfactants can also cause damage to the skin barrier. Synthetic detergents, or “syndets,” are a subset of surfactants designed to be the least irritating to the skin, a property that is achieved by limiting the impact on both the moisture barrier and the skin surface pH.^{1,2}

Allergic contact dermatitis to surfactants is a relatively new field, and evaluation of clinical data regarding coreactivity and cross-reactivity between these allergens is still in its early stages. Currently, there are 6 surfactants included on the North American Contact Dermatitis Group standard series (cocamidopropyl betaine, oleamidopropyl dimethylamine, decyl glucoside, dimethylaminopropylamine, amidoamine, and cocamide DEA), and according to the most recent North American Contact Dermatitis Group review of data from 2011 to 2012, the prevalence of contact allergy due to these surfactants ranges from 0.9% to 2.3%.³

While contact allergy to these surfactants is relatively uncommon, many consumer companies continue to develop newer generations of surfactants designed to be less irritating and less sensitizing. With the introduction of these new chemicals, dermatologists should continue to be mindful of the potential for new or rare

allergens that may not be screened for using standard patch test series. Herein, we report 2 cases of ACD to 3 novel allergens, all of which are amide-containing surfactants used in a hypoallergenic liquid cleanser.

Case 1

A 46-year-old female massage therapist with a history of contact allergy to multiple allergens presented to our patch test clinic with recurrent hand dermatitis. Initial patch testing in 2012 identified numerous allergies; of particular relevance were several acrylates, methylchloroisothiazolinone/methylisothiazolinone, and fragrances/botanicals, which were all identified in the patient's current contactants. The patient cleared with avoidance of these allergens and remained dermatitis free for 2 years; however, in the summer of 2014, her hand dermatitis recurred, and she returned for further patch testing.

Results of repeat patch testing at that time were generally consistent with previous results with the exception of a positive reaction to semiopen application of a hypoallergenic liquid cleanser unexplained by her known allergens. Our patient endorsed daily use of this cleanser for hand washing and even carried a travel-sized container of this product with her for use in public restrooms. We contacted the manufacturer of the liquid cleanser and were kindly provided samples for 9 of 12 individual ingredients for further patch testing. These chemicals were tested in vehicles and concentrations recommended by DeGroot⁴ (Table 1).

The patient developed reactions to 3 of the ingredients provided by the manufacturer (sodium lauroyl sarcosinate, disodium lauroamphodiacetate, isostearamidopropyl morpholine lactate) and again to the product itself (Table 1, Fig. 1). Since patch testing, the patient has been avoiding these allergens and has been clear of hand dermatitis for 11 months.

Case 2

The second patient was a 57-year-old healthy woman with a 10-year history of hand dermatitis; she too had undergone previous patch

*From the *University of Minnesota Medical School; †Department of Dermatology, University of Minnesota Medical School; and ‡Veterans Affairs Medical Center, Minneapolis, MN.*

*Address correspondence to: Jamie L. Hanson, BS, Veterans Affairs Medical Center, Dept 111 K 1 Veterans Dr, Minneapolis, MN 55417.
E-mail: richx077@umn.edu.*

The authors have no potential conflicts of interest to declare.

Disclaimer: The contents of this publication do not represent the views of the Department of Veterans Affairs or the US government.

This material is based upon work supported in part by the Minneapolis Veterans Affairs Medical Center. There are no other sources of funding for this work.

DOI: 10.1097/DER.0000000000000141

© 2015 American Contact Dermatitis Society. All Rights Reserved.

TABLE 1. Patient Reactions to Ingredients Tested

Chemical	Concentration	Vehicle	Patient 1	Patient 2
Disodium lauroamphodiacetate	1%	Aqueous	+	+
	2%		+	+
Glycerin	1%	Aqueous	—	—
	10%		—	—
Sodium lauroyl sarcosinate	0.1%	Aqueous	—	—
	0.5%		+/-	—
	1%		+	—
Isostearamidopropyl morpholine lactate	0.1%	Aqueous	—	—
	0.5%		—	+
	1%		+	+
PEG-120 methyl glucose dioleate	5%	Petroleum	—	—
	10%		—	—
Bis-PEG-18 methyl ether dimethyl silane	0.1%	Aqueous	—	—
	0.5%		—	—
	1%		—	—
Potassium sorbate	5%	Petroleum	—	—
Citric acid	1%	Aqueous	—	—
Tetrasodium EDTA	1%	Petroleum	—	—
	1%	Aqueous	—	—
Liquid cleanser (tested semiopen)	1%	—	—	—
	10%	—	—	—
	100%	—	+	+

*Patch test readings were performed at 48 and 96 hours; final reactions at 96 hours are shown in the table above.

testing with relevant positive reactions to rubber accelerators. Her hand dermatitis improved when she switched to vinyl gloves, however, never fully cleared. Repeat patch testing was consistent with

previous results, with the exception of a positive reaction to semiopen application of her hypoallergenic liquid cleanser, the same liquid cleanser as our initial patient. Patch testing to individual ingredients (Table 1) showed reactions to 2 of the ingredients (disodium lauroamphodiacetate, isostearamidopropyl morpholine lactate) and again to the liquid cleanser itself (Fig. 2). With avoidance of these allergens, this patient has been clear of hand dermatitis for 7 months.

Control Testing

Because these ingredients are not well-known sensitizers and potential irritants, we patch tested 10 healthy controls. Each control was tested to the 3 ingredients in the same vehicles and

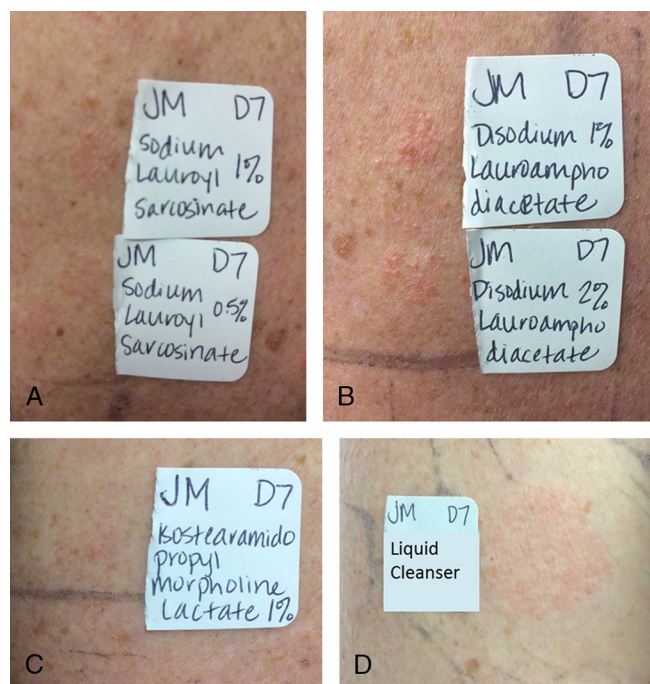


Figure 1. Photograph of case 1 patch test reactions on day 7. A, Sodium lauroyl sarcosinate. B, Disodium lauroamphodiacetate. C, Isostearamidopropyl morpholine lactate. D, Liquid cleanser (applied semiopen).

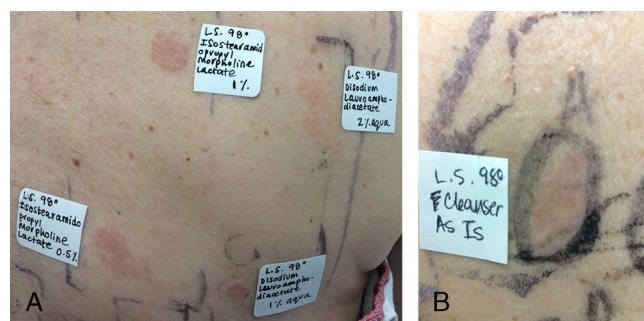


Figure 2. Photograph of case 2 patch test reactions on day 7. A, Positive (+) reactions to isostearamidopropyl morpholine lactate and disodium lauroamphodiacetate. B, Positive (+) reaction to liquid cleanser applied semiopen.

concentrations as well as the liquid cleanser, applied semiopen. There were no reactions in controls.

DISCUSSION

These 3 chemicals (Fig. 3) are amide-containing surfactants used in soaps, shampoos, and other cleansers. According to the Household Products Database of the National Library of Medicine, sodium lauroyl sarcosinate is contained in approximately 82 consumer products, while disodium lauroamphodiacetate and isostearamidopropyl morpholine lactate are found in 24 and 23 various consumer products, respectively.⁵ These surfactants are rare sensitizers, in fact, only sodium lauroyl sarcosinate has previously been reported as an allergen.⁶ The case report by Zemtsov and Fett describes a 41-year-old female nurse with occupational hand dermatitis; on patch testing, she was found to have a strong reaction to the liquid hand soap used at work.

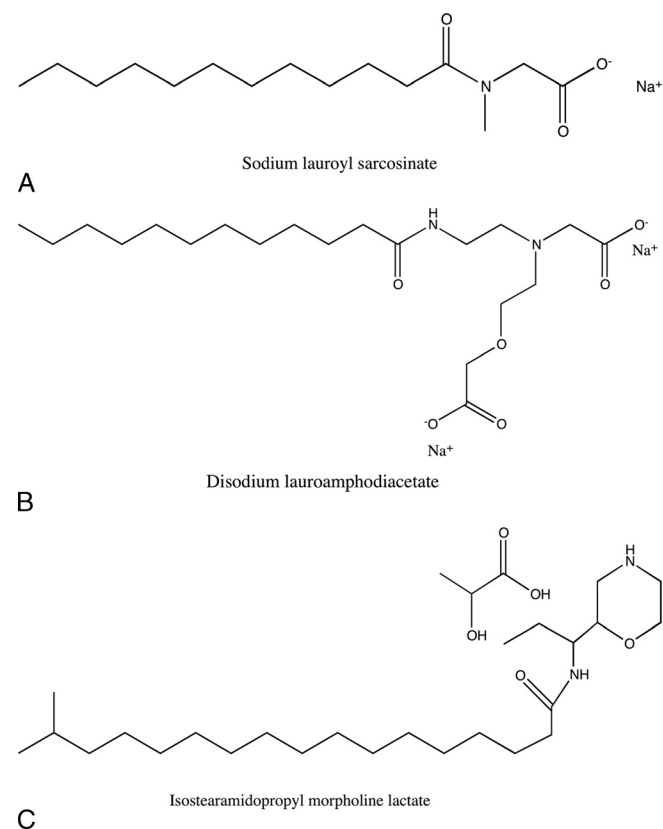


Figure 3. Chemical structure of 3 novel surfactant allergens. A, Sodium lauroyl sarcosinate. B, Disodium lauroamphodiacetate. C, Isostearamidopropyl morpholine lactate.

Further patch testing to individual ingredients revealed a strong reaction to a 30% aqueous solution of sodium lauroyl sarcosinate. While this concentration is much higher than the 1% that we used, there were 2 controls also tested to the 30% aqueous solution of sodium lauroyl sarcosinate, and both were negative.

We chose to test our patients to the liquid cleanser using a semiopen technique. Semiopen application was first described by Dooms-Goossens⁷ in 1995 and is typically used for personal care products with greater irritant potential. The semiopen technique involves direct application of a product to a small area of skin using a cotton applicator; after complete drying, the area is covered with nonocclusive tape and removed at the 48-hour visit. It is thought that the semiopen technique both improves sensitivity and reduces the number of irritant reactions.

Interestingly, both of our patients showed positive reactions to other amide-containing surfactants on patch testing, oleamidopropyl dimethylamine in patient 1 and cocamidopropyl betaine in patient 2. Given the structural configuration of these chemicals, we hypothesize that there may be cross-reactivity between these amide-containing surfactants.

CONCLUSIONS

In conclusion, the utility of semiopen testing to personal care products led to identification of 3 amide-containing surfactants as novel allergens in a hypoallergenic liquid cleanser.

REFERENCES

1. Ananthapadmanabhan KP, Moore DJ, Subramanyan K, et al. Cleansing without compromise: the impact of cleansers on the skin barrier and the technology of mild cleansing. *Dermatol Ther* 2004;17(Suppl 1):16–25.
2. Baranda L, González-Amaro R, Torres-Alvarez B, et al. Correlation between pH and irritant effect of cleansers marketed for dry skin. *Int J Dermatol* 2002;41:494–499.
3. Warshaw EM, Maibach HI, Taylor JS, et al. North American contact dermatitis group patch test results: 2011–2012. *Dermatitis* 2015;26(1):49–59.
4. DeGroot AC. *Patch Testing. Test Concentrations and Vehicles for 4350 Chemicals*. 3rd ed. Wapserveen, the Netherlands: Acdegroot Publishing; 2008.
5. The US Department of Health and Human Services. *The Household Products Database of the National Library of Medicine*. [database online]. Bethesda, MD: National Institutes of Health; Updated August 2014.
6. Zemtsov A, Fett D. Occupational allergic contact dermatitis to sodium lauroyl sarcosinate in the liquid soap. *Contact Dermatitis*. 2005;52(3):166–167.
7. Dooms-Goossens A. Patch testing without a kit. In: Guin JD, ed. *Practical Contact Dermatitis*. New York, NY: McGraw-Hill; 1995:63–74.