

Formaldehyde-Releasing Preservative in Baby and Cosmetic Products

Health Risks Related to Exposure During Infancy

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Once thought to be rare in the pediatric population, allergic contact dermatitis (ACD) is now recognized as a significant problem (Fernandez Vozmediano, Armario & Hita, 2005; Lewis, Statham, & Chowdhury, 2004; Seidenari, Giusti, Pepe, & Montovani, 2005). Rates of ACD in children are on the rise (Beattie, Green, Lowe, & Lewis-Jones, 2007; Jacob, Brod, & Crawford, 2008), perhaps due to increased exposure to sensitizing agents early in life (Militello, Jacob, & Crawford, 2006). Frequently listed among the most potent sensitizing agents are the preservatives and formaldehydes present in many everyday items (Hogeling & Pratt, 2008; Jacob et al., 2008; Pratt et al., 2004; Zug et al., 2008), including cosmetics, baby products, and topical antibiotics. In fact, formaldehyde is an extremely sensitizing agent and has been reported to evoke positive patch-test reactions at concentrations as low as 30 ppm (Jordan, Sherman, & King, 1979). The ubiquity of the formaldehyde-releasing preservatives (FRPs) is partially because they are inexpensive compounds which can be added to products to inhibit

the growth of microorganisms by slowly releasing formaldehyde over time. This extended-time-release feature allows the concentration of free formaldehyde contained in the products to remain low and theoretically lowers the risk of contact allergy (Sasseville, 2008). Nevertheless, many patients continue to develop allergy to formaldehyde and the FRPs (Jacob et al., 2008; Pratt et al., 2004).

QUATERNIUM-15

Repeatedly, the most sensitizing of these, quaternium-15 (Q15), has been shown to be a strong allergen (Hogeling & Pratt, 2008; Jacob et al., 2008; Marks, Belsito, & DeLeo, 2000; Pratt et al., 2004; Zug et al., 2008). At a concentration of 0.1%, Q15 releases 100 ppm of free formaldehyde—an amount that is well within the range to evoke an allergic response (Herbert & Rietschel, 2004). The North American Contact Dermatitis Group (NACDG) found that 9.3% of the 4,910 patients patch tested between 2001 and 2002 had relevant reactions to Q15 (Pratt et al., 2004). Even more concerning, the sensitization rates in children are also high (Hogeling & Pratt, 2008; Jacob, 2008; Zug et al., 2008). Zug et al. (2008) found that 3.6% of 0- to 18-year-olds referred for patch testing had clinically relevant reactions to Q15, placing it among the Top 6 allergens in this age group. This is not surprising given the fact that this product is contained in many baby products and potentially transferred caregiver cosmetics, and early age of contact with any compound is a known risk factor for sensitization later in life (Onder & Adisen, 2008; Nijhawan, 2009). Furthermore, Q15 has been determined by the NACDG to be even more sensitizing than formaldehyde (Pratt et al., 2004). In addition, it is present

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TABLE 1. Commonly Used Products Containing Quaternium-15

Brand	Category	Form
Radio Shack Anti Static Spray	Arts and crafts	Aerosol
Palmolive Ultra Antibacterial Hand Soap—August 26, 2004	Inside the home	Liquid
Vaseline Intensive Care Moisturizing Bath Beads Enriched With Aloe	Personal care	Capsules
Vaseline Intensive Care Moisturizing Bath Beads, Petal Soft	Personal care	Capsules
Freeman Beautiful Skin Apricot/Sea Kelp Scrub	Personal care	Paste
No More Tears Baby Shampoo	Personal care	Liquid
Keri Original Skin Care Lotion	Personal care	Liquid
Cover Girl Eye Enhancers Eye Shadow (1-Kit), matte	Personal care	Solid
Cover Girl Eye Enhancers Eye Shadow (4-Kit), matte	Personal care	Solid
Cover Girl Eye Enhancers Eye Shadow (3-Kit), matte	Personal care	Solid
Cover Girl Fresh Complexion Oil Control Makeup, cool	Personal care	Powder
Cover Girl Fresh Complexion Oil Control Makeup, warm	Personal care	Powder
Cover Girl Clean Fragrance Free Pressed Powder (ethnic)—July 28, 2000	Personal care	Powder
Aveeno Extra Gentle Cleansing Lotion		
Aveeno Body Wash, Skin Relief Fragrance Free with Natural Colloidal Oatmeal	Personal care	Liquid
Paul Mitchell Baby Don't Cry Shampoo	Personal care	Paste
Sesame Street Bubble Bath, Splashin Berry Bubbles	Personal care	Liquid
Johnsons Softwash Baby Wash	Personal care	Liquid
Johnsons Baby Bath, Original	Personal care	Liquid
Johnsons Baby Soothing Vapor Bath	Personal care	Liquid
Johnsons Soothing Skin Baby Bath	Personal care	Liquid
Johnsons Baby Shampoo, Honey & Vitamin E	Personal care	Liquid
Johnsons Baby Shampoo, 2 in 1 Detangler	Personal care	Liquid
Johnsons Kids, Head To Toe Body Wash, Berry Breeze	Personal care	Liquid
Baby Magic, Calming Massage Milk Lotion	Personal care	Liquid
Mr Bubble, Bubble Bath, Original	Personal care	Liquid
Vaseline Intensive Care Moisturizing Bath Beads, Peaceful Orchard		
Vaseline Intensive Care Moisturizing Bath Beads, Vitamin E	Personal care	Capsules
Johnsons Clean & Clear Foaming Facial Cleanser	Personal care	Capsules
Vidal Sassoon Alcohol Free Styling Gel Extra Hold	Personal care	Liquid
Cover Girl Cheekers Fashion Blush	Personal care	Gel
Cover Girl Clean Fragrance Free Pressed Powder	Personal care	Powder
Cover Girl Clean Pressed Powder	Personal care	Powder
Cover Girl Remarkable Washable/Waterproof Mascara	Personal care	Powder
Cover Girl Smoothers Pressed Powder	Personal care	Semisolid
Cover Girl Clean Shimmer Powder	Personal care	Powder
Cover Girl Fresh Look Pressed Powder	Personal care	Powder
Aveeno Skin Replenishing Cleansing Lotion with Soy Extract, Fragrance Free	Personal care	Powder
Aveeno Body Wash, Skin Relief with Natural Colloidal Oatmeal	Personal care	Liquid
Sesame Street Finger Paint Bubble Bath	Personal care	Paste
Cover Girl Professional Finishing Loose Powder (ethnic)	Personal care	Liquid
Johnsons Creamy Baby Oil	Personal care	Powder

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TABLE 1. (continued)

Brand	Category	Form
Johnsons Baby Bedtime Baby Bath	Personal care	Liquid
Johnsons Moisturizing Baby Bath with Aloe Vera & Vitamin E	Personal care	Liquid
Johnsons Baby Shampoo, Natural Lavender	Personal care	Liquid
Johnsons Baby Shampoo, Original	Personal care	Liquid
Johnsons Baby Head To Toe Wash, Original	Personal care	Liquid
Johnsons Kids, head to toe body wash, Tropical Blast	Personal care	Liquid
Mr Bubble, Bubble Bath, Bubbleberry with Skin Soother	Personal care	Liquid
Mr Bubble, Bubble Bath, Peachy Clean with Soothing Aloe	Personal care	Liquid
Cover Girl Eye Enhancers Eye Shadow (1-Kit), spun satin	Personal care	Liquid
Cover Girl Eye Enhancers Eye Shadow (4-Kit), spun satin	Personal care	Solid
Cover Girl Eye Enhancers Eye Shadow (3-Kit), spun satin	Personal care	Solid
Cover Girl Fresh Complexion Oil Control Makeup, neutral	Personal care	Solid
Cover Girl Classic Color Believable Blush—April 1, 2004	Personal care	Powder
Cover Girl Simply Powder Foundation—June 12, 2001	Personal care	Powder
Cover Girl Classic Color Believable Blush	Personal care	Powder
Cover Girl Clean Fragrance Free Pressed Powder (ethnic)	Personal care	Powder
Cover Girl Professional Finishing Loose Powder	Personal care	Powder
Cover Girl Simply Powder Foundation	Personal care	Powder
Cover Girl Clean Pressed Powder (ethnic)	Personal care	Powder
Cover Girl Crackle Lacquer	Personal care	Powder
Cover Girl Instant Cheekbones Contouring Blush	Personal care	Liquid

Note. Adapted from the U.S. Department of Health & Human Services (2008).

in an alarmingly high number of baby products, making exposure and potential sensitization at an early age increasingly common. In the recently released NACDG pediatric article, Q15 was shown to have sensitized 7% of the children younger than 5 years (Zug et al., 2008). Table 1 lists many commonly used products that contain

Q15. Table 2 lists the names of other FRPs and their rates of sensitization as reported by the NACDG.

CONCLUSION

All children presenting with recalcitrant dermatitis or with dermatitis in atypical areas, such as eyelid or hand

TABLE 2. Formaldehyde-Releasing Preservatives and Sensitization Rates in the General Population—Results From the North American Contact Dermatitis Group 2001–2002 Study Period

Preservative	Rate of Sensitization
Bromonitropropane diol (Bronopol)	3.3%
Diazolidinyl urea (Germall II)	3.2% at 1% aqs, 3.1% at 1% pet
DMDM hydantoin (Glydant)	2.2% at 1% aqs, 2.8% at 1% pet
Imidazolidinyl urea (Germall)	1.8% at 2% aqs, 3% at 2% pet
Quaternium-15	9.3%
Tris(hydroxymethyl)nitromethane (Tris Nitro)	Information unavailable
Sodium hydroxymethylglycinate	Information unavailable

Note. Adapted from Pratt et al. (2004). aqs = aqueous; pet = petrolatum; DMDM = 1, 2-dimethylol-5, 5-dimethyl.

eczema, should be referred for patch testing. Should the child react to Q15 (or any other allergen), a list of products used at home should be obtained and avoidance should be implemented. There are a number of alternative preservatives that are less allergenic that may suitable to take the place of Q15 and the other FRPs. Patient and parental education regarding the sources of exposure is paramount as avoidance may result in prevention of sensitization or an improvement in the child's existing dermatitis (Jacob et al., 2008). ■

REFERENCES

- Beattie, P. E., Green, C., Lowe, G., & Lewis-Jones, M. S. (2007). Which children should we patch test? *Clinical and Experimental Dermatology*, 32(1), 6–11.
- Fernandez Vozmediano, J. M., & Armario Hita, J. C. (2005). Allergic contact dermatitis in children. *Journal of the European Academy of Dermatology and Venereology*, 19, 42–46.
- Herbert, C., & Rietschel, R. L. (2004). Formaldehyde and formaldehyde releasers: How much avoidance of cross-reacting agents is required? *Contact Dermatitis*, 50(6), 371–373.
- Hogeling, M., & Pratt, M. (2008). Allergic contact dermatitis in children: The Ottawa hospital patch-testing clinic experience, 1996 to 2006. *Dermatitis*, 19(2), 86–89.
- Jacob, S. E., Brod, B., & Crawford, G. H. (2008). Clinically relevant patch test reactions in children—a United States based study. *Pediatric Dermatology*, 25(5), 520–527.
- Jacob, S. E., Burk, C. J., & Connelly, E. A. (2008). Patch testing: Another steroid-sparing agent to consider in children. *Pediatric Dermatology*, 25(1), 81–87.
- Jordan, W. P. Jr., Sherman, W. T., & King, S. E. (1979). Threshold responses in formaldehyde-sensitive subjects. *Journal of the American Academy of Dermatology*, 1(1), 44–48.
- Lewis, V. J., Statham, B. N., & Chowdhury, M. M. (2004). Allergic contact dermatitis in 191 consecutively patch tested children. *Contact Dermatitis*, 51, 155–156.
- Marks, J. G. Jr., Belsito, D. V., & DeLeo, V. A. (2000). North American Contact Dermatitis Group patch-test results, 1996–1998. *Archives of Dermatology*, 136, 272–273.
- Militello, G., Jacob, S. E., & Crawford, G. H. (2006). Allergic contact dermatitis in children. *Current Opinion in Pediatrics*, 18(4), 385–390.
- Nijhawan, R. I., & Jacob, S. E. (2009). Connubial dermatitis revisited: Mother-to-child contact dermatitis. *Dermatitis*, 20(1):55–56.
- Onder, M., & Adisen, E. (2008). Patch test results in a Turkish paediatric population. *Contact Dermatitis*, 58(1), 63–65.
- Pratt, M. D., Belsito, D. V., DeLeo, V. A., Fowler, J. F. Jr., Fransway, A. F., Maibach, H. I., et al. (2004). North American Contact Dermatitis Group patch-test results, 2001–2002 study period. *Dermatitis*, 15(4), 176–183.
- Seidenari, S., Giusti, F., Pepe, P., & Mantovani, L. (2005). Contact sensitization in 1094 children undergoing patch testing over a 7-year period. *Pediatric Dermatology*, 22, 1–5.
- Sasseville, D. (2008). Hypersensitivity to preservatives. *Dermatologic Therapy*, 17(3), 251–263.
- U.S. Department of Health & Human Services. (2008). *Household products database*. Retrieved November 26, 2008, from <http://householdproducts.nlm.nih.gov/cgi-bin/household/brands?tbl=chem&cid=138>
- Zug, K. A., McGinley-Smith, D., Warshaw, E. M., Taylor, J. S., Rietschel, R. L., Maibach, H. I., et al. (2008). Contact allergy in children referred for patch testing: North American Contact Dermatitis Group data, 2001–2004. *Archives of Dermatology*, 144(10), 1329–1336.