

Allergic Contact Dermatitis From Methylisothiazolinone in Residential Wall Paint

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A 33-year-old woman presented to our clinic for suspected photoallergic contact dermatitis with a recent episode of severe, vesicular dermatitis involving exposed skin and correlating with relocation to a new home. Biopsy results showed spongiotic and lichenoid dermatitis with eosinophils. Patch test results showed a very strong (+++) reaction to methylisothiazolinone (MI), mild (+) reaction to MI/methylchloroisothiazolinone, and no reaction to benzisothiazolinone. These allergens were found in several personal products. However, the patient was suspicious of 4 wall paints recently used in her home. Semiopen patch tests to 3 Behr interior paints showed positive results. Nine controls showed negative results. High-performance liquid chromatography demonstrated MI and benzisothiazolinone in all 4 paints at concentrations ranging from 50 to 100 ppm and 290 to 340 ppm, respectively. Although MI has been reported to cause occupational airborne contact dermatitis in European household painters, to our knowledge, this is the first documented case of paint-related MI allergy in the United States.

CASE REPORT

A 33-year-old female waitress presented to our Occupational and Contact Dermatitis Clinic with a history of 3 episodes of corticosteroid-responsive dermatitis. The first occurred 10 years before presentation, wherein the rash started on the face and then generalized. A biopsy from the face was consistent with rosacea. The second episode occurred 4 years before presentation and primarily involved the malar cheeks. The third episode occurred 5 months before presentation, which coincided with a residential move. The dermatitis started on the nares and central face before spreading to the eyelids, anterior "V" of the chest, hands, and forearms (Fig. 1). Bullae were present in the interdigital web spaces. Skin biopsies from the left shoulder and right forehead revealed spongiotic and lichenoid dermatitis with eosinophils. Skin direct immunofluorescence and serologic lupus antibody panels were normal.

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Because of the distribution and history of tanning bed use, the referring dermatologist suspected photoallergy. However, the patient denied any correlation with UV light exposure. She was very suspicious of the paint she used to paint the interior of her new home. The patient did not wear any protective clothing during painting.

Patch testing was performed with the North American Contact Dermatitis Group screening series (70 allergens) as well as several other series including preservatives, emulsifiers, cosmetics, perfumes/flavors, hair dressing chemicals, and 30 personal products. Patch testing showed a very strong (+++) reaction to methylisothiazolinone (MI) and a mild (+) reaction to MI/methylchloroisothiazolinone (MCI) (Fig. 2). Benzisothiazolinone (BIT) was negative. Other positive reactions are listed in Table 1.

Although the patient had a number of personal items containing MI, she was strongly suspicious of her interior wall paints. Four samples of Behr interior paint (Behr Process Corporation, Santa Ana, CA) were applied to Scanpor tape (SmartPractice, Phoenix, AZ), allowed to partially dry, and placed on the patient's arm in a semiopen fashion for 48 hours. Positive results were noted in 3 of the 4 samples (Fig. 3). To rule out irritancy, subsequent testing was performed using the same semiopen technique in 9 volunteer control subjects; all showed negative results at 96 hours (Fig. 4).

Personal communication with the paint manufacturer indicated that MI was present in some of the raw materials used in paint manufacturing but was not present in the final product. Samples of the 4 paints were sent to the Department of Occupational and Environmental Dermatology in Malmö, Sweden, for analysis. Samples were analyzed for the presence of MI, MCI, BIT, and butylbenzisothiazolinone (BBIT) using a high-performance liquid chromatography system described in detail elsewhere.¹ A



Figure 1. Pink eczematous plaques involving the patient's face, neck, and anterior V of the chest.

0.4-g sample from each paint specimen was added to approximately a 10-mL solvent mixture of methanol/0.4% formic acid (20/80, vol/vol). Materials were in turn mixed, placed in an ultrasonic bath for 10 minutes, and centrifuged at 4000 rpm for 5 minutes. Upon completion, samples were filtered twice—once through glass wool and then through a polypropylene filter (0.45 μ m) (VWR International, Radnor, PA)—before being administered into the high-performance liquid chromatography device. The injection volume was 10 μ L. An Aquasil C₁₈ column (5 μ m, 4.5-mm internal diameter $\times$ 250 mm) (Thermo Scientific, Waltham, MA) was used. The mobile phase consisted of acetonitrile/water (30/70, vol/vol) in an isocratic elution system with a flow rate of 1 mL/min. The identity of the substances was determined from the retention time and the UV spectrum. The reference substances were Kathon CG (Rohm and Haas, Philadelphia, PA), which consists of both MCI and MI, BIT (Fluka Chemika, Buchs, Switzerland), and BBIT (Chemos GmbH, Regenstauf, Germany). The quantification was performed by using a linear calibration curve with 3 concentration points.



Figure 2. The patient's very strong (+++) reaction to MI and mild (+) reaction to MI/MCI 5 days after application.

TABLE 1. Positive Test Results for Patient 5 Days After Application

Allergen	5-d Reaction
MI (0.2% aq)	+++
MI/MCI (0.01% aq)	+
<i>p</i> -Phenylenediamine (1.0% pet)	++
Thimerosal (0.1% pet)	++
Nickel (2.5% pet)	+
Cobalt (1.0% pet)	+
Carmine (2.5% pet)	+

aq, Aqueous; pet, petrolatum.

Methylisothiazolinone and BIT were found in all 4 samples at concentrations ranging from 50 to 100 ppm and 290 to 340 ppm, respectively (Table 2). Neither BBIT nor MCI was detected in the samples.

Although several of the patient's personal products contained MI and could partially explain her dermatitis, the severe outbreak coinciding with exposure to residential indoor paint, positive results of semiopen patch tests to paint samples, and laboratory confirmation of MI in paint samples strongly support the likelihood of airborne allergic contact dermatitis due to MI in paint. The patient was able to stay in her current home, and at 3 months' follow-up, her skin was clear.

DISCUSSION

Methylisothiazolinone is a common preservative used in the manufacture of many personal care products as well as household and industrial items. Over the last decade, allergic contact



Figure 3. The patient's 48-hour reaction to 3 individual Behr interior paint samples.



Figure 4. Negative paint control reactions 5 days after application.

dermatitis to MI has significantly increased in both North America and Europe.^{2–4} In Europe, there have been several cases of airborne contact dermatitis secondary to the presence of MI in paints,^{5–11} and, given the volatile nature of MI, it has been estimated that 75% of MI paint-related allergic reactions are secondary to airborne exposure.¹² Air emission of MI from painted surfaces has been shown to peak a few hours after application, but detectable levels can persist for days.¹³ A recent analysis of 71 household paints from 5 European countries revealed the presence of MI in more than 90% of the samples.¹⁴ To our knowledge, the presence of MI in North American paints has not been investigated.

As a result of the increase in allergy associated with MI, the European Union (EU) has issued guidance on permissible concentrations of MI allowed in consumer products.¹⁵ Currently, the EU has banned MI in leave-on products and allows MI in a concentration of 100 ppm for rinse-off products.¹⁶ For paints and varnishes, to receive an EU Ecolabel, the permissible level for all

isothiazolinones together must not exceed 500 ppm.¹⁷ In the United States, only ingredients considered “hazardous” must be declared on material safety data sheets of household products.

Despite MI being present in all 4 paint samples, the patient had reactions to only 3 of the 4 specimens. This may be due to sampling variation.

This case underscores several important points for clinicians. First, the current epidemic of MI and MI/MCI allergy in North America extends beyond personal care products to include residential paint. Second, patch testing to patient-provided materials is helpful in identifying allergen source and clinical relevance. Finally, access to laboratory analysis is crucial in confirming ingredient content, especially in cases involving proprietary formulations.

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TABLE 2. Concentrations of MI and BIT in Select Behr Paint Samples

Sample	Color	MI (ppm)	BIT (ppm)
Behr Ultra Plus Interior/Exterior Color Sample	White	96.14	291.60
Behr Premium Plus Ultra Interior Semi-Gloss Enamel	Base 3750 natural gray	53.92	342.60
Behr Premium Plus Ultra Interior Flat Matte	Base 1753 suede gray	68.89	301.60
Behr Premium Plus Ultra Stain Blocking Paint and Primer in One Interior Semi-Gloss Enamel	Base 3753 mined coal	80.79	304.00

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