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Occupational hand eczema caused by nickel allergy and semi-quantified by dimethyl glyoxime testing of the skin

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Nickel allergy is common in the general population. Sensitization often occurs following prolonged or repeated skin contact with consumer items, but nickel is also an important cause of occupational allergic contact dermatitis. Accordingly, excessive nickel exposure has been shown in many occupations (1–3). As it is important for clinicians to confirm and quantify occupational nickel exposure, practical and inexpensive tools are needed.

Lidén et al. validated an acid wipe sampling method for quantification of nickel deposition on the skin (4). The method is accurate, but is also time-consuming and costly for daily practice; thus, a simpler method is warranted. The dimethyl glyoxime (DMG) test is a rapid, inexpensive semi-quantitative colorimetric test that is positive when $> 0.5 \mu\text{g Ni}/\text{cm}^2/\text{week}$ is released from a metallic item (5). Recently, Julander et al. showed the value of DMG testing of the skin following contact with metallic items (6).

We report a female patient with severe hand eczema caused by occupational exposure to nickel in whom we confirmed nickel skin deposition with the DMG test.

Case Report

A 32-year-old non-atopic woman presented with palmar hand eczema of 5 years duration. Initially, it was vesicular, but over the years became more hyperkeratotic and chronic (Fig. 1). The patient worked in a factory producing electronic devices. She handled many different metallic parts and tools, and metallic electronic components. The patient described complete resolution of dermatitis



Fig. 1. Dimethyl glyoxime testing in a patient with occupational hand dermatitis caused by nickel allergy.

during 1 year of maternity leave, and rapid recurrence after she returned to work. Patch testing with the European baseline series according to ICDRG recommendations showed an extreme positive (++++) test reaction to nickel sulfate 5% pet. on D2. We then asked the patient to use the DMG test at her workplace, where she identified nickel release from several items that she handled on a normal workday.

To confirm and quantify nickel deposition on the patient's hands, we performed DMG testing of her palms and fingers before and after 2 hrs of work, and found negative test results before the work and strong positive results thereafter (Fig. 1). Positive test results were stronger on her left hand, which correlated with dermatitis, which was also more severe on her left hand. Because the patient was right-handed, she mostly held nickel-releasing metallic items in her left hand while operating tools with her right hand.

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We then tested again after the patient had performed 2 hrs of work wearing nitrile rubber gloves. The DMG test gave a positive result on the outer layer of the gloves (Fig. 1), but a negative result on the inside. The patient was therefore instructed to use these gloves while at work, which led to clear improvement of the hand eczema.

Discussion

Our case shows the importance of considering relevant occupational nickel exposure in nickel-sensitized patients. Wall and Calnan reported an outbreak of occupational dermatitis in an electroforming plant resulting from heavy exposure to nickel, and the incidence of dermatitis decreased immediately after industrial hygiene was improved (7). Importantly, Wall also showed

penetration of nickel through rubber gloves (8). Hence, it is important to perform a comprehensive evaluation of nickel exposure at the workplace as well as quantifying nickel deposition on the skin. Skin testing should normally be performed on intact skin. Our patient had severe chronic hand eczema, and as complete remission was not readily achievable, testing was performed on palms with slight dermatitis, but without fissuring. Although DMG skin testing is safe, it has some limitations; it has only been shown to reveal nickel concentrations above $0.13 \mu\text{g}/\text{cm}^2$, and the nickel deposits can be masked by other particles or dirt on the skin; hence, negative results should be assessed carefully (6). We have, however, in this case confirmed the value of DMG testing as a practical, easy tool to demonstrate nickel deposition on the skin in clinical practice.

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