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Cobalt spot test used for diagnosis of occupationally-related exposure to cobalt-containing powder

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A cobalt spot test was recently developed (1). Testing for cobalt release is performed by dipping a white cotton stick into a clear yellow cobalt test solution containing nitroso R salt, followed by rubbing of the cotton stick for 20–30 seconds against the test item. A colour change from yellow to red–orange indicates a positive test reaction. The spot test detects approximately 8 ppm cobalt in a solution (1, 2). The cobalt spot test has proven to be useful for screening purposes, and we have shown that surprisingly few jewellery items, hair clasps, mobile phones and work tools release cobalt in significant amounts (3–5). We have also used the cobalt test in the diagnostic work-up of patients with allergic cobalt dermatitis, but have only identified cobalt release in very few cases (6). Here, we report a novel use of the cobalt spot test in a patient with allergic cobalt dermatitis in whom exposure resulted from a powdered product.

Case Report

A 53-year-old non-atopic woman was referred with recurrent dermatitis. She had worked in porcelain manufacturing at the Royal Copenhagen for about 35 years. Her main area of expertise had been manual manufacture of porcelain (e.g. cream jugs) by using

a turning table, where she had hand skin contact with ceramic raw materials. She formed the ceramic raw material into the desired shapes with her hands, by using an electric turning table. She did not paint the finished porcelain, and did not have direct skin contact with paints. She had always suffered from intermittent dry skin following work, but had never had dermatitis. One year prior to presentation in our clinic, she was transferred to a new work section at the factory. She still worked at a turning table, handling ceramics and performing the same tasks, but now she was standing next to a new machine that produced fine porcelain automatically. The porcelain-manufacturing process was enclosed within the machine. The porcelain items were spray painted with a solution containing cobalt–zinc–silicate–blue–phenacite powder and water. The machine delivered painted porcelain items just next to where she stood, for them to dry and cool. Soon after her transfer, she developed dermatitis on the neck, upper chest, shoulders, and elbow flexures. She did not use any forms of protection (e.g. apron or gloves) but only wore a T-shirt, as she always did. Dermatitis was localized to areas characteristically affected by airborne dermatitis, and especially areas where the clothes had close skin contact. She reported a facial burn and a feeling of tight skin after work hours. Topical corticosteroids and calcineurin inhibitors were effective, but the dermatitis reappeared rapidly after cessation of their use. Also, periods of vacation resulted in clearance of dermatitis. Patch testing with the baseline series, an extended fragrance series and her own cosmetic products showed a positive patch test reaction to cobalt chloride 1% pet. on day 2 (++) and a doubtful reaction on day 3. During testing, the patient experienced flare-ups of dermatitis on sites of previous dermatitis. Inspection of data safety sheets showed that cobalt–zinc–silicate–blue–phenacite

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Conflicts of interest: Jacob P. Thyssen and Morten S. Jellesen sold the cobalt spot test to SmartHealth (Phoenix, AZ, USA) after its development, and will receive annual royalty fees for net sales of the spot test. Torkil Menné and Jeanne D. Johansen have no conflict of interest to disclose.

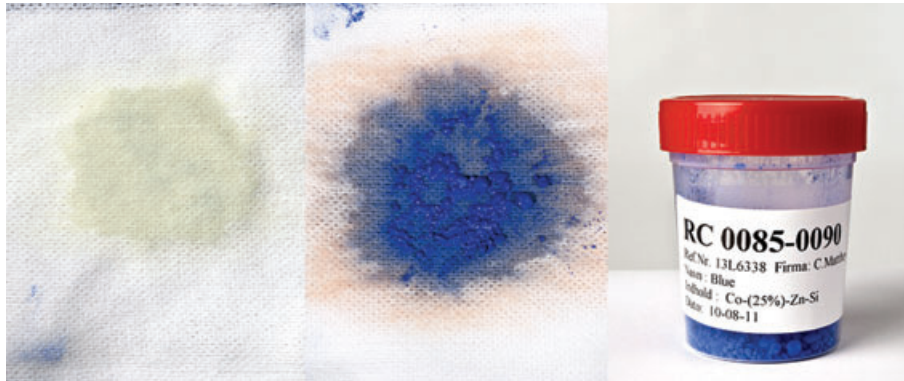


Fig. 1. Left: the yellow cobalt test solution. Middle: the blue cobalt–zinc–silicate powder used for colouring porcelain is added to a napkin, and the yellow cobalt test solution is poured over it. A red–orange halo is noted, indicating cobalt release. Right: cobalt–zinc–silicate–blue–phenacite sample.

(13L6338) (Johnson Matthey Colour Technologies, London, UK) was mixed into the solution that was used for decoration of porcelain in the machine. The cobalt spot test was used in a new manner. Briefly, the blue cobalt powder was added to a napkin, and the yellow cobalt test solution (approximately 5 ml) was then poured over it. Instantly, an orange–red halo was noted around the blue powder (Fig. 1), indicating that cobalt ions were released in amounts that may result in allergic cobalt dermatitis. No quantitative measurements were performed. When we performed the cobalt spot test in this manner, the amounts of powder and test solutions that were mixed seemed not to matter, as we performed the test several times and obtained the same result. However, we estimate that a considerable amount of cobalt test solution should be applied, so that the orange-coloured halo surrounding the powder is wide enough for the naked eye to detect the colour change. We did not perform any measurements to identify the lowest amount necessary.

Discussion

We have convincingly shown an association between exposure to a cobalt–zinc–silicate-containing powder,

cobalt release as indicated by an orange–red halo (Fig. 1), and clinical disease. We have used the cobalt spot test in a similar way in an actress suffering from facial dermatitis and who was diagnosed with cobalt and nickel allergy. Although she used a lot of make-up during work nights, and cobalt can be found in high amounts in eye shadows (7), we could not identify any red–orange halo around her make-up powders. Hence, in that case, we could not establish the clinical relevance of cobalt allergy. We conclude that the cobalt spot test may be useful in the diagnostic work-up of patients with cobalt allergy who have been exposed to powdered products, albeit cobalt release is infrequently encountered. Although we have not tested this, available commercial kits (e.g. the reveal and conceal Cobalt Spot Test™ by Allerderm Phoenix, AZ, USA) may not be used in the way proposed in this case report, as they contain preloaded cotton sticks, making it difficult to mix the solution with the powder.

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