

Cellular Phone and Cellular Phone Accessory Dermatitis Due to Nickel Allergy: Report of Five Cases

David R. Berk, M.D., and Susan J. Bayliss, M.D.

Department of Internal Medicine and Pediatrics, Division of Dermatology, Washington University School of Medicine and St. Louis Children's Hospital, St. Louis, Missouri

Abstract: Cellular phone dermatitis, also known as mobile phone dermatitis, is a recently recognized condition due to either nickel or chromate allergy. Cellular phone dermatitis has most often been reported in young adults and less commonly in adolescents. We describe five adolescents whose cellular phone dermatitis was caused by nickel allergy.

Cellular phone dermatitis is a newly recognized condition that is still infrequently reported, especially in the pediatric literature. To our knowledge, 26 cases have been reported (1–12), including five patients younger than 18 years (2,3,8,12). Cases are caused by allergic contact dermatitis to either chromate or nickel. We report five patients with cellular phone dermatitis due to nickel allergy.

CASES

Table 1 summarizes our five cases. Patient ages ranged from 12 to 18 years. Four patients had a history of atopic dermatitis and known nickel dermatitis. Two patients had eczematous plaques on both cheeks, while three patients had unilateral lesions. All patients had cell phones, which tested positive for nickel using a dimethylglyoxime test kit in the office (Figs. 1–4).

REPRESENTATIVE CASE

Patient 1. This 12-year-old African American male had a history of atopic dermatitis and nickel allergy.

He presented with increased itching on the right side of the face and neck. He had previously avoided nickel in belt buckles, pants, and jewelry. On his right cheek, a distinct plaque of eczematous dermatitis was seen corresponding to the wireless Bluetooth headset for his cellular phone (Fig. 1). The headset tested positive for nickel using dimethylglyoxime. With avoidance of that headset and the use of pimecrolimus cream, his nickel dermatitis improved.

DISCUSSION

Nickel allergy occurs frequently, and it is rising in incidence (13). It is especially common in children (13) and often acquired early in life (14). Nickel allergy is the most common allergy found in patch-tested children (15). Positive patch testing to nickel is often relevant (15). Recently, concerns have been raised regarding the development and significance of nickel allergy in patients with nickel-containing biomedical devices such as endovascular stents (16,17). For these reasons and others, nickel was named Contact Allergen of the Year for 2008 (18).

Address correspondence to David R. Berk, M.D., Campus Box 8123, 4921 Parkview Place, St. Louis, MO 63110, or e-mail: dberk@dom.wustl.edu.

TABLE 1. Summary of Cases of Cell Phone and Cell Phone Accessory Dermatitis Due to Nickel Allergy

Case no.	Age, yrs	Sex	Ethnicity	PMH	Clinical presentation	DMG test*
1	12	M	AA	AD, nickel dermatitis	Right facial and neck dermatitis	Positive
2	17	F	C	AD, nickel dermatitis	Bilateral facial dermatitis	Positive
3	16	F	AA	AD, nickel dermatitis	Bilateral facial dermatitis	Positive
4	18	M	AA	Psoriasis, acne	Right cheek dermatitis	Positive
5	14	F	AA	AD, nickel dermatitis, asthma	Left facial dermatitis	Positive

M, male; F, female; AA, African American; C, Caucasian; AD, atopic dermatitis; DMG, dimethylglyoxime.

*DMG test kit demonstrated nickel-positive cell phones in four cases and Bluetooth headset in one case.



Figure 1. Hyperpigmented, excoriated plaques on the right preauricular region and right side of the neck in Patient 1.

Patient education and allergen avoidance are critical in the management of nickel allergy. European legislation (specifically the European Union Nickel Directive of 1994) limiting the content and release of nickel from many products that contact the skin seems to have succeeded in reducing nickel sensitization among youth, but similar regulations have not been made in the United States. Moreover, despite regulation, nickel allergy remains the most frequent contact allergy in Europe possibly because of occupational nickel exposure, importation of nickel-containing products from abroad, and use of local nickel-containing products not covered by the European Union Nickel Directive (19). Dimethylglyoxime test kits are useful tools for patients to identify nickel-containing materials. Dimethylglyoxime and ammonium hydroxide solutions are applied to a cotton swab, which is then rubbed on the possible allergen, turning pink if free nickel is present. Barrier coatings (such as clear nail polish and cyanoacrylate) may be used to prevent release of nickel from products onto skin, but they have a high failure rate (20). Moreover, nail polish and cyanoacrylates are allergens themselves and can be sensitizing. In addition to avoidance, other behavioral factors such as delaying ear piercing or timing ear

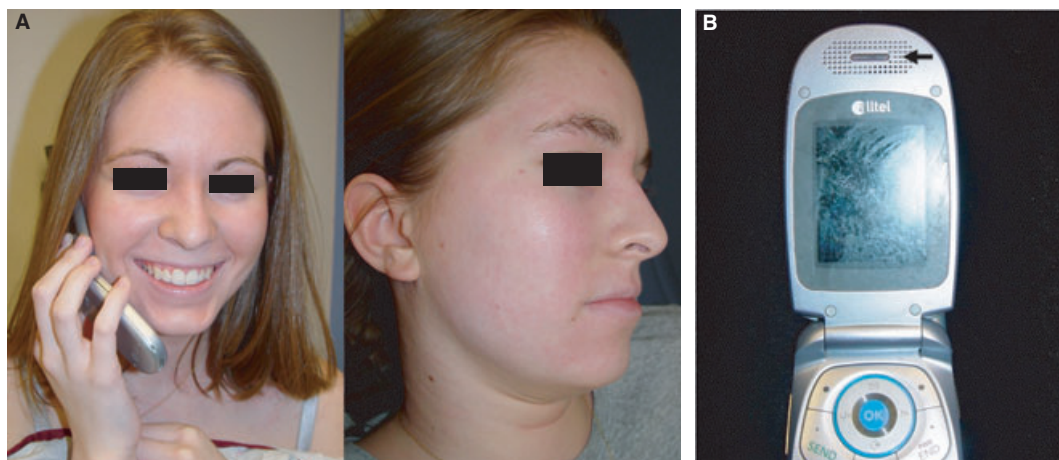


Figure 2. (A) Eczematous plaques over the right ear, cheek, and chin in Patient 2. (B) Patient's cellular phone with arrow on button, which tested positive for nickel.



Figure 3. Hyperpigmented, lichenified, excoriated plaque on the right cheek in Patient 4.

piercing subsequent rather than before receiving nickel-containing dental braces may modify sensitization rates (21,22). Dietary nickel is unlikely to be contributory to patients' dermatitis (23). Although studies evaluating possible genetic factors in the development of nickel allergy have been inconclusive (24), recent observations suggest that filaggrin deficiency seen in atopic patients may predispose to nickel sensitization (25).

Despite the high rate of nickel allergy in the United States, nickel remains ubiquitous. Classic sources include jewelry, blue-jean buttons, belt buckles, zippers, suspenders, coins, tools, cosmetics, and occupational materials (especially with wet work) (26). The female predominance of nickel allergy is most likely related to their more frequent ear and body piercing, and more frequent usage of jewelry in general. Typical presentations of nickel allergy include periumbilical or earlobe eczematous dermatitis.

Less common, emerging newer sources for nickel allergy include eyeglasses, body piercing, complementary and alternative topical medicines (27), and cellular phones. Cellular phone dermatitis was first reported in the literature in 2000 in two adults with nickel allergy (1). We are aware of a total of 26 reported cases of cellular phone dermatitis, including five patients younger than 18 years (1–12). Most reported cases have involved young adults aged 18 to 35 years. While many of the reported patients with cellular phone dermatitis have been due to chromate allergy, most articles on this subject have been case reports due to nickel allergy. Overall, 15 cases were thought to be due to nickel allergy (12 of whom were females), while 11 cases were due to chromate allergy (2,3). In reaction to these reports, the European Union Nickel Directive has recently been extended to cover cellular phones (28). Although many patients presented with fairly acute (several weeks to 1–2 months) pruritic eczematous papules and plaques on the lateral cheeks, ears, or both (3), the initial description had a case of 8 months' duration (1), and symptoms may persist for more than 1 year before diagnosis (7). The preauricular region has most commonly been affected,

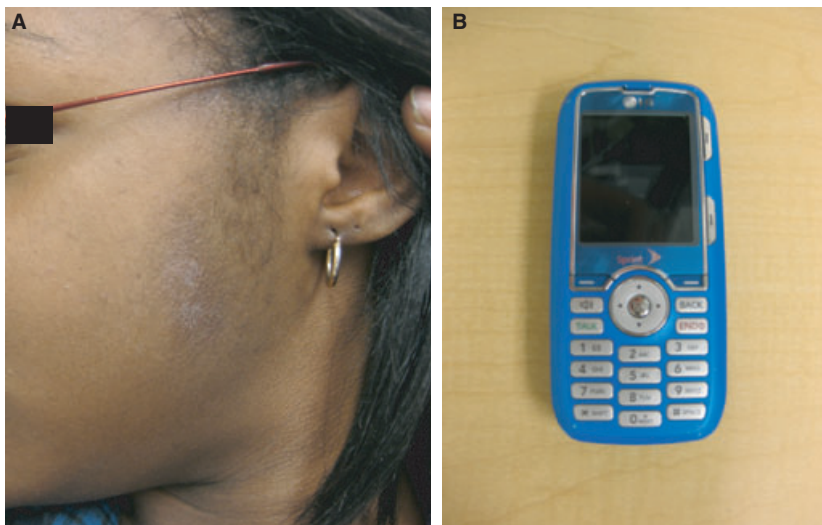


Figure 4. (A) Hyperpigmented, scaly plaque on the left cheek in Patient 5. (B) Patient's cellular phone with arrow pointing to the metal rim that tested positive for nickel.

although involvement of the hemilateral auricle has also been highlighted (3). The chin was involved in one patient (1), but typically lesions occurred more superiorly and laterally. Lesions were often unilateral or at least more pronounced on one side. Some patients had discrete, well-demarcated lesions in geometric shapes corresponding to buttons on the phone (8). Lesions may even be vesicular (7). Among patients with cellular phone dermatitis, due to either nickel or chromate allergy, many patients have had a history of jewelry intolerance or concomitant periumbilical dermatitis.

To our knowledge, allergy to Bluetooth and similar headset devices have previously been hypothesized but not clearly demonstrated to cause allergic contact dermatitis (6,7). Two studies (6,7) have surveyed commercially available phones and wireless communication devices to determine the prevalence of free nickel. Bercovitch and Luo (6) performed nickel spot testing of 23 wireless communication devices from nine manufacturers. Free nickel was identified on 10 of the 23 devices, usually on menu buttons, headset decorative logos, and liquid crystal display frames. They observed that the less fashionable, more rugged models with rubber coating were less likely to contain surface nickel. Thyssen et al (7) found positive nickel spot testing on 8 out of 41 phones from two cellular phone companies in Denmark, including three phones, which had more than one positive spot. They noted that demonstration phones in company stores are not made of the same substances as the real phones sold, suggesting the nickel spot testing of demonstration phones prior to purchase is insufficient. Furthermore, they stated that even for phones of one identical individual model, the parts may vary depending on "availability and prices at the time of production" (i.e., may come from different suppliers and be made of different materials) such that one phone might contain nickel, but another phone of the same model might not. The impact of the increasing use of text messaging on the rate of nickel sensitization remains unknown. Finally, the buttons on phones often have a barrier coating and may not cause contact dermatitis until the coating wears off, which we believe may be the case in several of our patients.

Chromate is considered a common cause of allergic contact dermatitis, but it is uncommon in children. Typical sources of chromate include hexavalent chromium in industrial settings (wet cement, stainless steel), as well as tanned leather (shoes), matches, felt green fabrics, antirust products, paints, and yellow-green cosmetics and tattoos.

Pediatric dermatologists should be aware that cellular phone dermatitis is an emerging problem, which is likely to be more common than has been reported, especially

among adolescents. Patch testing may be helpful, particularly in patients whose cellular phone dermatitis is due to chromate allergy. A known history of metal allergy or the presence of a concomitant generalized reaction, periumbilical, or earlobe dermatitis may provide a clue to the diagnosis of cellular phone dermatitis due to nickel or chromate allergy. Using a dimethylglyoxime test kit in the office to demonstrate the presence of nickel in patients' cellular phones can add evidence and help convince patients of the diagnosis and need for avoidance. A high suspicion for this diagnosis should be maintained when evaluating patients with eczematous dermatitis on the preauricular cheeks or ears, especially if unilateral, or in geometric shapes, or both. Finally, cellular phone manufacturers and patients with known nickel or chromate allergies should both be made aware of this phenomenon (6).

REFERENCES

1. Pazzaglia M, Lucente P, Vincenzi C et al. Contact dermatitis from nickel in mobile phones. *Contact Dermatitis* 2000;42:362–363.
2. Seishima M, Oyama Z, Yamamura M. Cellular phone dermatitis. *Arch Dermatol* 2002;138:272–273.
3. Seishima M, Oyama Z, Oda M. Cellular phone dermatitis with chromate allergy. *Dermatology* 2003;207:48–50.
4. Livideanu C, Giordano-Labadie F, Paul C. Cellular phone addiction and allergic contact dermatitis to nickel. *Contact Dermatitis* 2007;57:130–131.
5. Wohrl S, Jandl T, Stingl G et al. Mobile telephone as new source for nickel dermatitis. *Contact Dermatitis* 2007; 56:113.
6. Luo J, Bercovitch L. Cellphone contact dermatitis with nickel allergy. *CMAJ* 2008;178:23–24.
7. Thyssen JP, Johansen JD, Zachariae C et al. The outcome of dimethylglyoxime testing in a sample of cell phones in Denmark. *Contact Dermatitis* 2008;59:38–42.
8. Waters A, Green CM, Lewis-Jones S. Mobile phone dermatitis: a modern presentation of contact allergy. Paper presented at: British Society for Paediatric Dermatology 22nd Annual Symposium; November, 2007; London.
9. Lee DY, Yang JM. Preauricular eczema: a sign of cellular phone dermatitis. *Clin Exp Dermatol* 2010;35:201–202.
10. Madhukara J, Kumaran MS, Abraham A. Cell phone dermatitis. *Indian J Dermatol Venereol Leprol* 2008; 74:500–501.
11. Kluger N, Raison-Peyron N, Guillot B. [Contact dermatitis to nickel related to cellular phone use]. *Presse Med* 2009;38:1694–1696.
12. Moennich JN, Zirwas M, Jacob SE. Nickel-induced facial dermatitis: adolescents beware of the cell phone. *Cutis* 2009;84:199–200.
13. Rietschel RL, Fowler JF, Warshaw EM et al. Detection of nickel sensitivity has increased in North American patch-test patients. *Dermatitis* 2008;19:16–19.
14. Bruckner AL, Weston WL, Morelli JG. Does sensitization to contact allergens begin in infancy? *Pediatrics* 2000; 105:e3.

15. Jacob SE, Brod B, Crawford GH. Clinically relevant patch test reactions in children—a United States based study. *Pediatr Dermatol* 2008;25:520–527.
16. Honari G, Ellis SG, Wilkoff BL et al. Hypersensitivity reactions associated with endovascular devices. *Contact Dermatitis* 2008;59:7–22.
17. Koster R, Vieluf D, Kiehn M et al. Nickel and molybdenum contact allergies in patients with coronary in-stent restenosis. *Lancet* 2000;356:1895–1897.
18. Kornik R, Zug KA. Nickel. *Dermatitis* 2008;19:3–8.
19. Mortz CG, Andersen KE. New aspects in allergic contact dermatitis. *Curr Opin Allergy Clin Immunol* 2008;8:428–432.
20. Sprigle AM, Marks JG Jr, Anderson BE. Prevention of nickel release with barrier coatings. *Dermatitis* 2008;19:28–31.
21. Mortz CG, Lauritsen JM, Bindslev-Jensen C et al. Nickel sensitization in adolescents and association with ear piercing, use of dental braces and hand eczema. The Odense Adolescence Cohort Study on Atopic Diseases and Dermatitis (TOACS). *Acta Derm Venereol* 2002;82:359–364.
22. Kutting B, Brehler R, Traupe H. Allergic contact dermatitis in children: strategies of prevention and risk management. *Eur J Dermatol* 2004;14:80–85.
23. Di Berardino F, Alpini D, Cesarani A. Nickel earlobe dermatitis and clinical non-relevance of the oral exposure. *J Eur Acad Dermatol Venereol* 2008;22:1215–1217.
24. Schram SE, Warshaw EM. Genetics of nickel allergic contact dermatitis. *Dermatitis* 2007;18:125–133.
25. Novak N, Baurecht H, Schafer T et al. Loss-of-function mutations in the filaggrin gene and allergic contact sensitization to nickel. *J Invest Dermatol* 2008;128:1430–1435.
26. Shah M, Lewis FM, Gawkrödger DJ. Nickel as an occupational allergen. A survey of 368 nickel-sensitive subjects. *Arch Dermatol* 1998;134:1231–1236.
27. de Medeiros LM, Fransway AF, Taylor JS et al. Complementary and alternative remedies: an additional source of potential systemic nickel exposure. *Contact Dermatitis* 2008;58:97–100.
28. Thyssen JP, Johansen JD. Mobile phones are now covered by the European Union Nickel Directive. *Contact Dermatitis* 2009;61:56–57.