CASE REPORT

A Case of Chromium Contact Dermatitis due to Exposure from a Golf Glove

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Chromium is a transition metal and has been shown to elicit contact dermatitis. Although leather products have been known to be the most significant source of chromium exposure these days, the majority of reports have been related to exposure from shoe products. We herein report a professional golfer who became allergic to golf gloves made of chromium-tanned leather. A 27-year-old woman golfer presented with recurrent, pruritic, erythematous plaques that had been occurring on both hands for several years. The lesions developed whenever she had worn golf gloves for an extended period of time, especially during tournament season. To identify the causative agent, patch tests were performed and the results demonstrated a strong positive reaction to potassium dichromate 0.5% and to her own glove. The amount of chromium in her golf glove was analyzed to be 308.91 ppm and based on this, a diagnosis of allergic contact dermatitis due to a chromium-tanned leather glove was made. She was treated with oral antihistamines combined with topical steroids and advised to wear chromium-free leather gloves. There has been no evidence of recurrence during a six month follow-up period. (*Ann Dermatol* 22(1) 63~65, 2010)

-Keywords-

Chromium, Contact dermatitis, Leather, Tanning

INTRODUCTION

Chromium is a well-known contact allergen. It can be found in pigments, chrome-plated metals, cement, detergents, and in industrial chromium waste dumps¹. However, chromium-tanned leather product has become the most significant source of chromium exposure these days². Therefore, there are concerns that wearing chromium-tanned leather gloves can provoke a relapse of hand dermatitis in chromium sensitive patients. Although primary sensitization is rare, it has been observed in workers using wet gloves in jobs where other sources of chromium exposure have been excluded.

In the Korean literature, there have been several reports of chromium contact dermatitis due to contact with cements, detergents³, brassieres⁴, and cellular phones⁵; however, a case due to a chromium-containing glove has not yet been reported.

We herein present a case of allergic contact dermatitis due to leather golf gloves in a patient free from any underlying dermatoses.

CASE REPORT

A 27-year-old female patient presented with a lengthy history of recurrent hand dermatitis. A physical examination of her hands revealed a number of scaly erythematous plaques on both the dorsal and palmar sides of the hands (Fig. 1A). She was a professional golfer and otherwise was in good health. The skin lesions improved with an application of a topical steroid and she experienced a disease-free period for several months. After five months, she presented to our office with new skin lesions on a similar area, accompanied by a severe itching sensation. Her hands exhibited more severe form of erythematous plaques than those seen previously (Fig. 1B).

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Fig. 1. (A) Several scaly erythematous plaques on the dorsal and palmar sides of the hands. (B) More severe skin lesions on the same area after five months.

Fig. 2. (A) A strong positive reaction to No.1 potassium dichromate 0.5% (++) with ICDRG scoring system) and a moderate positive reaction to No.7 nickel sulfate 5% (+) at 48 hours using the Korean standard patch test. (B) The 'As is' patch tests demonstrated positive reactions to the gray (++) and black (+) glove fragments.

She stated that her hand lesions were related to wearing golf gloves, especially when worn for an extended period of time.

We performed patch tests with the Korean standard series, shoe series, rubber series, epoxy series, and with pieces of her own glove. Her glove was gray, white, and black and for the patch test, was split into pieces according to the individual colors. Results showed a strong positive reaction to No.1 potassium dichromate 0.5% (++) with ICDRG scoring system) and a moderately positive reaction to No.7 nickel sulfate 5% (+) at 48 hours and 72 hours (Fig. 2A). The patch tests with pieces of her own glove indicated positive reactions (+) to the gray and black

fragments (Fig. 2B). We suspected that her glove may have contained considerably high amounts of chromium and therefore, we analyzed the chromium content in the glove, which was found to be 308.91 ppm. The content of nickel in the glove was also analyzed and was found to be as low as 10 ppm.

Based on our results, she was diagnosed with allergic contact dermatitis due to a chromium-tanned leather glove. The skin lesions improved through the use of oral antihistamines and topical steroids. Further, we advised her to wear chromium-free leather gloves and explained that re-exposure to chromium-containing leather gloves could cause a recurrence of contact dermatitis. No recurrence has occurred during a six month follow-up period.

DISCUSSION

Chromium is a transition metal which can exist in various valency states. The most common oxidation states of chromium are +3 (trivalent) and +6 (hexavalent). Hexavalent chromium (Cr(VI)) is a well-known contact allergen, and is able to elicit contact dermatitis at very low concentrations. Trivalent chromium (Cr(III)) is also capable of eliciting dermatitis, but studies indicate that Cr(III) compounds are less potent⁶.

In the past, cement has been the major cause of chromium dermatitis; however, ferrous sulfate, added to cement since 1981 in Denmark, has resulted in a reduction in the incidence of chromium allergies⁷. Recently, chromium has been widely used in the tanning process of leather⁸. Tanning is a process which permanently alters and stabilizes the collagen structure of the leather. Chromium

tanning produces stretchable leather, which produced an excellent material for handbags, shoes, and gloves. Only Cr(III) is used for the tanning process; however, Cr(VI) may be found in the final leather product due to the oxidation of Cr(III) during the tanning process⁹. In contrast to Cr(III), Cr(VI) is a poor protein binder and therefore, it easily leaks from the leather and contacts the skin. Once Cr(VI) penetrates the skin, it is reduced to Cr(III), which is capable of forming covalent bonds with the immune cells of the skin¹⁰.

In Korea, the chromium content of leather products has not been regulated by law. As enter the 21st century, many investigators have attempted to identify non-sensitizing levels of chromium, and some European economic union countries have adopted restrictions stating that the concentration of chromium in various products must be below the detection limit¹¹. Currently, the analytic detection limit is approximately 3 mg per kg (ppm) in leather, whereas in our case, the analyzed chromium content in the glove was 308.91 ppm, about one hundred times higher than that of the detection limit.

Gloves usually form an occlusive environment, inducing perspiration, and ultimately making the gloves wet with sweat. Subsequently, the sweat causes unbound chromium to leach from the leather, while the occlusive environment itself promotes the penetration of the chromium into the skin¹². Moreover, the patient in our case was a professional golfer, and as such, wore leather gloves almost every day for extended periods of time. This may have been why she developed chromium sensitization and elicited contact dermatitis.

We were unable to find any domestic manufacturers of chromium-free leather and unfortunately, it appeared as though, most merchants were based in western countries. In conclusion, physicians should consider chromium contact dermatitis in patients with relapsing hand

dermatitis. Particular attention should be paid in workers using leather gloves occupationally.

REFERENCES

1. Andersen PH, Nangia A, Bjerring P, Maibach HI. Chemical and pharmacologic skin irritation in man. A reflectance spectroscopic study. *Contact Dermatitis* 1991;25:283-289.
2. Hansen MB, Rydin S, Menne T, Duus Johansen J. Quantitative aspects of contact allergy to chromium and exposure to chrome-tanned leather. *Contact Dermatitis* 2002;47:127-134.
3. Suh DH, Eun HC. An analysis of chrome in cements and bleaching detergents. *Korean J Dermatol* 1990;28:11-15.
4. Yoo HD, Lee MH, Choi JM, Haw CR. An analysis of chrome in brassieres. *Korean J Dermatol* 1994;32:620-625.
5. Kim BJ, Li K, Woo SM, Cho WI, Cho SY, Kim MN, et al. Clinical observation of cellular phone dermatitis in Korea. *Korean J Dermatol* 2006;44:35-39.
6. Basketter D, Horev L, Slodovnik D, Merimes S, Trattner A, Ingber A. Investigation of the threshold for allergic reactivity to chromium. *Contact Dermatitis* 2001;44:70-74.
7. Zachariae CO, Agner T, Menne T. Chromium allergy in consecutive patients in a country where ferrous sulfate has been added to cement since 1981. *Contact Dermatitis* 1996;35:83-85.
8. Nygren O, Wahlberg JE. Speciation of chromium in tanned leather gloves and relapse of chromium allergy from tanned leather samples. *Analyst* 1998;123:935-937.
9. Hansen MB, Menne T, Johansen JD. Cr(III) and Cr(VI) in leather and elicitation of eczema. *Contact Dermatitis* 2006;54:278-282.
10. Graf D. Formation of Cr(VI) traces in chrome-tanned leather: causes, prevention and latest findings. *J Am Leather Chem Assoc* 2001;96:169-179.
11. Shelnutt SR, Goad P, Belsito DV. Dermatological toxicity of hexavalent chromium. *Crit Rev Toxicol* 2007;37:375-387.
12. Hansen MB, Johansen JD, Menne T. Chromium allergy: significance of both Cr(III) and Cr(VI). *Contact Dermatitis* 2003;49:206-212.