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Allergic contact dermatitis caused by 3-*o*-ethyl-L-ascorbic acid (vitamin C ethyl)

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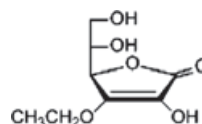
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Key words: allergic contact dermatitis; cosmetics; 3-*o*-ethyl-L-ascorbic acid; skin-lightening agent; vitamin C ethyl.

Skin-lightening agents such as kojic acid, arbutin, ellagic acid, lucinol and 5,5'-dipropylbiphenyl-2,2'-diol are used in 'anti-ageing' cosmetics. Cases of allergic contact dermatitis caused by these skin-lightening agents have been reported (1, 2). Vitamin C and its derivatives have also been used in cosmetics as skin-lightening agents for a long time. Vitamin C in topical agents is poorly absorbed through the skin, and is easily oxidized after percutaneous absorption. Recently, ascorbic acid derivatives have been developed with enhanced properties. The ascorbic acid derivative 3-*o*-ethyl-L-ascorbic acid (CAS no. 86404-04-8, molecular weight 204.18; Fig. 1), also known as vitamin C ethyl, is chemically stable and is more easily absorbed through the skin than the other vitamin C derivatives. Moreover, 3-*o*-ethyl-L-ascorbic acid has skin-lightening properties. Here, we report a case of allergic contact dermatitis caused by a skin-lightening lotion containing 3-*o*-ethyl-L-ascorbic acid.

Case Report

A 49-year-old female presented with a 6-month history of periocular erythema and perioral swelling. She had applied a skin-lightening lotion to the face every summer for the past 6 years. In the previous summer, an itchy erythematous rash appeared on her face. She stopped using the lotion, and consulted a dermatologist. She received a 3-day course of mequitazine (6 mg daily), betamethasone (1 mg daily), and teprenone (150 mg daily), as well as topical corticosteroid ointments



Molecular formula: C₈H₁₂O₆

Molecular weight: 204.18

CAS no. : 86404-04-8

Fig. 1. Chemical formula of 3-*o*-ethyl-L-ascorbic acid (vitamin C ethyl).

(prednisolone acetate for the periocular skin lesion, and hydrocortisone butyrate for the face).

We performed patch tests with the patient's personal cosmetics and cosmetic allergens at our hospital outpatient clinic. Finn Chambers® (Smart Practice, Phoenix, AZ, USA) mounted on Scanpor® tape (Norgesplaster AS, Vennesla, Norway) were applied to the upper back for 2 days, and the reactions were read on D2, D3 and D7 according to International Contact Dermatitis Research Group criteria. A positive reaction to the skin-lightening lotion (neat) was observed (D3, +; D7, +), and the repeated open application test (ROAT) resulted in an itchy erythema. A second patch test with the skin lotion ingredients was performed, and gave positive reactions to 3-*o*-ethyl-L-ascorbic acid in 5% pet. (D3, +; D7, +), 1% pet. (D3, +; D7, +), 0.5% pet. (D3, +; D7, +), 0.1% pet. (D3, +; D7, +), and 0.05% pet. (D3, +; D7, +), but not in 0.01% pet. From the patch test findings, the patient was diagnosed with allergic contact dermatitis caused by 3-*o*-ethyl-L-ascorbic acid. The minimum positive concentration of 3-*o*-ethyl-L-ascorbic acid was 0.05% pet. We examined ascorbyl tetraisopalmitate (CAS no. 183476-82-6) 1% pet. and magnesium ascorbyl phosphate (CAS no. 114040-31-2) 1% pet. as vitamin C derivatives. We

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performed patch test using the same substances on the inner side of the upper arms of three healthy controls. They showed negative reactions.

Discussion

Vitamin C and its derivatives have been deemed to be safe for use in cosmetics. The Cosmetic Ingredient Review reported that L-ascorbic acid, calcium ascorbate, magnesium ascorbyl phosphate, sodium ascorbate and sodium ascorbyl phosphate are safe for use in cosmetic products (3). Despite the cosmetic safety of vitamin C derivatives such as magnesium L-ascorbyl 2-phosphate and ascorbic acid 2-glucoside, they lack antioxidant properties, and rapidly lose their effectiveness. New vitamin C derivatives have been produced with enhanced stability. 3-*o*-Ethyl-L-ascorbic acid is a new vitamin C derivative that is more stable, with preservation of its vitamin C activity (4), and is currently used in cosmetics as a skin-lightening agent. Cases of allergic

contact dermatitis caused by L-ascorbic acid-containing and ascorbyl tetraisoalmitate-containing creams have been reported (5, 6), as have cases of delayed-type allergy caused by oral ingestion of vitamin C (7), but allergic contact dermatitis caused by 3-*o*-ethyl-L-ascorbic acid has not been reported to date.

In this report, we describe a case of allergic contact dermatitis caused by a skin-lightening lotion containing 3-*o*-ethyl-L-ascorbic acid. The maximum concentration of 3-*o*-ethyl-L-ascorbic acid in the skin lotion is 2%. The patient had a positive patch test reaction to the skin lotion, and an itchy erythema and papules appeared at the ROAT application site. Patch testing with the ingredients of the skin lotion indicated that 3-*o*-ethyl-L-ascorbic acid was the causative allergen. Different concentrations (5%, 1%, 0.5%, 0.1%, 0.05%, and 0.01%) of the allergen in pet. were patch tested, and showed the minimum positive concentration to be 0.05% pet. To the best of our knowledge, our case is the first reported case of contact dermatitis caused by 3-*o*-ethyl-L-ascorbic acid.

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