



Three cases of photoallergic contact dermatitis induced by benzophenone in amusement park wristbands

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KEYWORDS: benzophenone, CAS no. 119-61-9, CAS no. 22071-15-4, case report, chemical analyses, cross-reaction, ketoprofen, photoallergic contact dermatitis, photopatch test, wristband

Ketoprofen is known to cause allergic and photoallergic contact dermatitis and to cross-react with several chemicals, including benzophenone-type ultraviolet (UV) absorbers¹ and octocrylene. Three patients who wore the same type of amusement park wristband in the same summer developed dermatitis at the site of the wristband.

CASE REPORTS

A 10-year-old boy, a 15-year-boy and an 18-year-girl consulted Wakatsu clinic in summer 2017 with a similar type of dermatitis on the right wrist (Figure 1). Each had worn a wristband as a free pass at the amusement park of a resort facility 1 to 7 days before consultation. Previously, each of the three had been treated for dermatitis induced by topical application of 2% ketoprofen-containing tape (Mohrus; Hisamitsu Pharmaceutical, Tosu, Japan) at the same clinic. Extracts of the wristband body and adhesive were analysed with gas chromatography/mass spectrometry (Supporting Information Figure S1). The detected substances were the same in four types of wristband (Supporting information Figure S2). The main polyethylene body was coated with an acrylic acid ester. Benzophenone was assumed to have been added as a UV absorber. 1,6-Hexanediol diacrylate is an acrylic acid ester monomer, and Irgacure 907 (2-methyl-4'-[methylthio]-2-morpholinopropiophenone) and 2-isopropylthioxanthone were thought to be used as initiators of polymerization of acrylate ester. The adhesive was a rubber-type adhesive, and contained bis[4-(2-phenyl-2-propyl)phenyl] amine as an antioxidant. All patients underwent patch testing and photopatch testing with the detected substances, which were applied in duplicate symmetrically to the backs of the patients with Finn Chambers on Scanpor tape (SmartPractice, Yokohama, Japan) for 2 days. One side was irradiated with 5 J/cm² UVA. Readings were performed on day (D) 2, D3, or D4, and D7, according to ICDRG recommendations. One patient had a contact allergic reaction to benzophenone 5% pet. (Table 1). In all three cases, the photopatch test with benzophenone 1% pet. showed a positive reaction (Supporting Information Figure S3; Table 1). No other positive reactions were seen. On the basis of the

above findings, the dermatitis in the three cases was diagnosed as photoallergic contact dermatitis caused by unsubstituted benzophenone.

DISCUSSION

Measures have been taken² to prevent photosensitivity and dermatitis related to ketoprofen; however, our three patients had experienced dermatitis after using ketoprofen-containing tape, and photosensitization to ketoprofen had been established (Figure 1). Each of them developed dermatitis after wearing an amusement park wristband. The wristband contained benzophenone, which is the main component of the chemical structure of ketoprofen. Although benzophenone was most likely the cause of the dermatitis, patch tests and photopatch tests were necessary, because Irgacure 907 and 2-isopropylthioxanthone have a similar chemical structure to benzophenone (Supporting Information Figure S2), and 1,6-hexanediol diacrylate and bis[4-(2-phenyl-2-propyl)phenyl]amine have sensitizing potential. As the patients had positive reactions only in the photopatch test with benzophenone, the agent responsible for the dermatitis caused by the wristband was determined to be benzophenone. This reaction could be attributable to the cross-reaction between ketoprofen and benzophenone. As seen in our cases, sensitization to ketoprofen is not infrequently established in young people, so it is crucial for people to be aware of how to use ketoprofen-containing products. Otherwise, as with the current cases, dermatitis may occur from an unexpected cause,³ from ingredients in items such as sunscreen and cosmetics.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

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Case 3: An enlarged band-shaped erythema one week after wearing a wristband on her right wrist.



Case 1: Photopatch test showing a strong positive reaction to 2.5% ketoprofen 1 day after 5 J/cm² UVA irradiation



Four different wristbands used as a free pass at an amusement park

FIGURE 1 Three patients who had been treated for photocontact dermatitis caused by ketoprofen-containing tape and had a positive photoallergic reaction to ketoprofen developed dermatitis after wearing an amusement park wristband. UV, ultraviolet

TABLE 1 Results from patch tests (PTs) and photopatch tests (PPTs) with substances detected in the wristband

	PT									PPT								
	Case 1			Case 2			Case 3			Case 1			Case 2			Case 3		
	D2	D3	D7	D2	D4	D7	D2	D3	D7	D2	D3	D7	D2	D4	D7	D2	D3	D7
BP 5%	+	?+	-	-	-	-	-	-	-	-	NT	NT	-	NT	NT	-	NT	NT
BP 1%	-	-	-	-	-	-	-	-	-	-	+	+	-	++	++	-	++	?+
Main body 5% pet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Adhesive 5% pet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AO445 0.2% pet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HDDA 0.1% pet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IQ907 1% pet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-ITX 1% pet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations: 2-ITX, 2-isopropylthioxanthone; AO445, bis[4-(2-phenyl-2propyl)phenyl]amine; BP, benzophenone; D, day; HDDA, 1,6-hexanediol diacrylate; IQ907, 2-methyl-4'-(methylthio)-2-morpholinopropiophenone; NT, not tested.

For case 3, the positive photopatch test reaction to 1% benzophenone was very strong on D3, treated with topical diflorasone diacetate after D3.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Tanahashi T, Sasaki K, Numata M, Matsunaga K. Three cases of photoallergic contact dermatitis induced by benzophenone in amusement park wristbands. *Contact Dermatitis*. 2019;80:191-193. <https://doi.org/10.1111/cod.13173>