

## BRIEF ARTICLE

**Evolution of a Doxycycline-Induced Phototoxic Rash with an Unusual Distribution**Katrina Kesterson MS<sup>a</sup>, Adrian Subrt MD<sup>b</sup>, Michael Wilkerson MD<sup>b</sup><sup>a</sup>University of Tennessee Health Science Center, College of Medicine, Memphis, TN<sup>b</sup>University of Texas Medical Branch, Department of Dermatology, Galveston, TX**ABSTRACT**

Commonly used in clinical practice, doxycycline has been known to produce a cutaneous phototoxic reaction in combination with sunlight. Several mechanisms have been proposed to contribute to its pathogenesis such as UVA oxidation of cellular components, the formation of photoproducts, and altered melanogenesis. We describe a case of a phototoxic rash in a patient taking doxycycline 100 mg daily for the treatment of rosacea. We present several photos of the rash from erythema to desquamation several weeks later. The clinical presentation of a doxycycline-induced phototoxic rash varies from a sunburn like sensation to diffuse erythematous plaques on sun exposed areas. Treatment involves discontinuing the drug and providing symptomatic relief. Although sunscreen may prevent a doxycycline-induced phototoxic reaction, it is important to educate the patient to use a sunscreen with protection in the 340-400 nm range in which phototoxic reactions are thought to occur. As doxycycline-induced phototoxicity is poorly understood, it may be best to advise the patient to avoid sun exposure altogether while taking the drug.

**CASE REPORT**

A 62-year-old Caucasian female with a history of rosacea presents for evaluation of a rash on her dorsal fingers. She has been taking doxycycline 100 mg by mouth daily for rosacea which has kept it well-controlled. She states she wore fingerless gloves but otherwise was covered by clothing during a recent 21-day motorcycle trip. She did not use sunscreen on her hands. The rash began on the third day of the trip and lasted approximately a month while she was taking doxycycline. Of note, she also had acrylic fingernails at the time. By the time she

arrived at the dermatology clinic the rash has resolved, but she presents with numerous photos depicting a severe phototoxic reaction of the distal dorsal fingers including initial erythema and edema on day 3 (Figure 1), blistering on day 7 (Figure 2) which led to well-demarcated areas of desquamation on an erythematous base (Figure 3) several days later. The rash completely resolved after one month. Interestingly, the acrylic on her fingernails may have prevented the development of onycholysis. She continued to take doxycycline until she presented in clinic and was advised to discontinue taking the drug to prevent another episode of phototoxicity.



Figure 1. Erythema and edema of the dorsal fingers on day 3 of symptoms.



Figure 2. Well-demarcated areas of desquamation on an erythematous base.



Figure 2. Blistering and erythema on day 10.

## DISCUSSION

Although several mechanisms have been described in literature, the pathogenesis of doxycycline-induced phototoxicity is poorly understood. UVA oxidation of cellular components such as the cell membrane, DNA, RNA, ribosomal proteins, and mitochondria by a singlet oxygen may be a contributing factor. Secondly, the formation of tetracycline photoproducts causes an increase in the absorption of visible radiation (>400 nm) that may also damage the skin.<sup>1</sup> In addition, UVA in combination with doxycycline increases melanogenesis, affects melanocyte viability, and reduces antioxidant enzymes in a dose-dependent fashion.<sup>2</sup> Although melanin absorbs UV radiation and acts as an antioxidant, it may oxidize at higher doses which leads to additional cell damage.<sup>3</sup>

The clinical presentation of doxycycline induced phototoxicity may vary from a sunburn-like sensation to diffuse erythematous plaques on sun-exposed areas.<sup>4,5</sup> The rash generally resolves within 10-14 days after discontinuation of the drug.<sup>5</sup> In addition, several case reports of onycholysis due to doxycycline induced phototoxicity have been described in adults and children. Onycholysis of the nails presents as a crescent-shaped separation of the distal nail bed affecting several or all sun-exposed nails that may occur up to two weeks after discontinuation of the drug.<sup>6</sup>

Based on studies in current literature, the incidence of doxycycline phototoxicity follows a dose-dependent trend. In patients taking 100 mg/day of doxycycline, a phototoxic reaction was observed in 16% of patients (n=135).<sup>4</sup> In patients taking a 150 mg/day dose, the incidence was 20% (n=30).<sup>5</sup> In patients taking 200 mg/day of

doxycycline, the incidence varied among studies, but was observed to be as high as 42% in a study comparing 150 mg to a 200 mg per day dose (n=76).<sup>5</sup>

Although sunscreen may prevent a doxycycline-induced phototoxic reaction, it is important to educate the patient on using a sunscreen with an appropriate range of protection. In one study, 16% (n=135) of troops deployed to an island of East Timor within the Malaysian archipelago had a phototoxic reaction to doxycycline (100 mg daily) prescribed for malaria prophylaxis while using sunscreen. The sunscreen applied by the troops had a sun protection factor of 15 and contained oxybenzone 3% as its only protectant against UVA.<sup>4</sup> Oxybenzone partially absorbs UVA radiation up to 360 nm.<sup>7</sup> Phototoxic eruptions, however, are thought to be due to radiation in the UVA1 spectrum of 340-400 nm.<sup>8</sup> Zinc oxide may be a better choice of sunscreen as it is the only sunscreen that offers protection against UVB and UVA radiation up to 400 nm.<sup>7</sup>

Limited data exists on dermatologists' recommendations regarding sunscreen as well as patient perception and compliance. Based on a study by Farberg et al. surveying 156 dermatologists, all recommended an SPF greater than 30 and the majority considered broad-spectrum coverage an important characteristic when recommending sunscreen.<sup>9</sup> In a patient who might be on doxycycline long-term, it may be useful to educate the patient on applying a broad-spectrum formulation, protecting commonly missed areas such as the hands, frequent application, and covering sun-exposed areas with clothing. Additional

studies would be useful to determine the most effective sunscreen formulation and sun protection factor to prevent doxycycline phototoxicity.

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**References:**

1. Hasan T, Kochevar IE, Mcauliffe DJ, et al. Mechanism of Tetracycline Phototoxicity. *Journal of Investigative Dermatology*. 1984;83(3):179-183.
2. Rok J, Buszman E, Beberok A, et al. Modulation of Melanogenesis and Antioxidant Status of Melanocytes in Response to Phototoxic Action of Doxycycline. *Photochemistry and Photobiology*. 2015;91(6):1429-1434.
3. Wood SR, Berwick M, Ley RD, et al. UV causation of melanoma in Xiphophorus is dominated by melanin photosensitized oxidant production. *Proceedings of the National Academy of Sciences*. 2006;103(11):4111-4115.
4. Lim D, Murphy G. High-level ultraviolet A photoprotection is needed to prevent doxycycline phototoxicity: lessons learned in East Timor. *British Journal of Dermatology*. 2003;149(1):213-214.
5. Layton A, Cunliffe W. Phototoxic eruptions due to doxycycline—a dose-related phenomenon. *Clinical and Experimental Dermatology*. 1993;18(5):425-427.
6. Rabar D, Combemale P, Peyron F. Doxycycline-Induced Photoonycholysis. *Journal of Travel Medicine*. 2006;11(6):386-387.
7. Baron E, Stevens S. Sunscreens and immune protection. *British Journal of Dermatology*. 2002;146(6):933-937.
8. Bjellerup M, Ljunggren B. Differences in phototoxic potency should be considered when tetracyclines are prescribed during summer-time. A study on doxycycline and lymecycline in human volunteers, using an objective method for recording erythema. *British Journal of Dermatology*. 1994;130(3):356-360.
9. Farberg AS, Glazer AM, Rigel AC, White R, Rigel DS. Dermatologists' Perceptions, Recommendations, and Use of Sunscreen. *JAMA Dermatology*. 2017;153(1):99.