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Title:

Photo urticaria caused by exposure to LED emitting 633 nm wavelength during hot yoga exercise.

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Abstract

Photo urticaria (PU) is a rare type of urticaria that develops after exposure to various wavelengths of light. Inducing urticarial wheals using light sources of pertinent wavelengths can help make the definitive diagnosis of PU. The action spectra (AS) in Japanese patients with PU commonly fall within the ultraviolet radiation A and visible light range. Herein, to the best of our knowledge, we present the first case of PU caused by 633 nm wavelength within the visible light spectrum. Our patient worked as a "hot yoga" instructor, where light-emitting diodes (LEDs) on the ceiling were used to irradiate the entire room with 633 nm wavelength of light for "light treatment." She reported itching and wheals on the face and neck during her "hot yoga" sessions. "Hot yoga" has recently gained popularity globally. The "light treatment" is based on the theory that 633 nm wavelength light within the visible light spectrum reportedly prevents the skin from aging. We induced wheals with erythema by irradiating her skin using a 633 nm LED at a dose of 0.008 J/cm^2/s for 1 h. Her condition was diagnosed as PU caused by exposure to 633 nm. Light. Her symptoms have not recurred since she has avoided being exposed to the 633 nm wavelength of LED light.

To the Editor:

Photo urticaria (PU) is a rare form of inducible urticaria presenting as cutaneous wheals and erythema following skin exposure to light from visible, ultraviolet radiation (UV)-A, and UV-B spectra.[1-3] Women in their twenties are most commonly affected by PU.[1] The diagnosis of PU is confirmed after successfully inducing urticaria using different light sources.[1-3] For Japanese patients with PU, action spectra (AS) (causative spectra) commonly fall into UV-A and/or visible light.[1-3] Herein, to the best of our knowledge, we present the first case of PU caused by 633 nm wavelength light of the visible spectrum.

A 23-year-old woman without history of allergic reactions experienced wheals and erythema in sunlight-exposed areas. She was working as a yoga instructor for "hot yoga," where light-emitting diodes (LEDs) mounted all over the ceiling were used as a source of red light (633 nm) as a part of "light treatment." She reported repetitive itching and wheals on the face and neck during her "hot yoga" sessions. These wheals disappeared spontaneously until the next day. The dermatologists she consulted at first prescribed her topical steroids; however, her symptoms failed to improve. Suspecting the "light treatment" as the cause, she used sunscreen before her yoga sessions, which also did not improve her symptoms. Subsequently, she was referred to our hospital for further treatment.

We conducted photo-tests after suspecting PU. No wheals were observed after 6, 12, and 18 J/cm^2 of UV-A irradiation, and neither erythema nor wheals were observed within a few hours of 150 mJ/cm^2 UV-B irradiation. However, erythema was observed 30 min after irradiation with visible light using a slide projector. Interestingly, wheals with erythema and itching developed upon irradiating the skin with 633 nm wavelength of light using a 633 nm LED (approximately 30 J/cm^2) without an increase in the

temperature of the irradiated skin. This particular irradiation source is generally used for photodynamic therapy and does not include other wavelength of light. Moreover, the same irradiation (approximately 30 J/cm^2) did not induce any erythema and itching in an individual without PU. General laboratory tests did not identify any other possible causes, and no other physical conditions, including exercise and temperature change, induced urticaria. Accordingly, we diagnosed her condition as PU caused by 633 nm wavelength of light and instructed her to avoid exposure to the same light. Her symptoms have not recurred since then.

"Hot yoga" has recently gained popularity globally. The practice involves performing a yoga session in a room which is heated to above body temperature. The "light treatment" is based on the concept that 633 nm wavelength light reportedly prevents the skin from aging.[4,5] Irradiation with 633 nm wavelength light reportedly upregulates type 1 procollagen and decreases matrix metalloproteinase (MMP)-1 and MMP-2 levels in skin fibroblasts,[4] preventing the formation of wrinkles.

It is essential to reproduce the symptoms by photo-tests to accurately diagnose PU. We reproduced the cutaneous symptoms (wheals with erythema and itch) using a 633 nm wavelength LED lamp, the same wavelength used in the "hot yoga" sessions.

After 30 min of irradiation with visible light using a slide projector, we observed erythema without wheals. The reaction might have been delayed because AS (633 nm wavelength) was a small fraction of the visible light. In addition, inhibition wavelength might have been present in a part of visible white light,[1-3] as whole visible light spectrum is quite broad.

Sunscreen application was ineffective in preventing PU in the patient because customary sunscreen formulations typically protect the skin against UV but are ineffective at blocking longer wavelengths, such as 633 nm wavelength of light.

Various wavelengths of light can induce PU. In our case, the patient was sensitive to a specific wavelength of 633 nm. Our case report highlights the potential risks associated with artificial and forced irradiation at a specific wavelength of light.

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Figure legend

Figure 1. Photo-tests in the presented patient.

(A) No wheals are observed after 6, 12, and 18 J/cm^2 of UV-A irradiation.

(B) Neither erythema nor wheals are observed within a few hours of 100, 120, and 150 mJ/cm^2 UV-B irradiation.

(C) Wheals with erythema are observed after irradiation using a 633 nm light-emitting diode (approximately 30 J/cm^2).

(D) Provocation test using visible light showing itchy erythema 30 min after the end of irradiation.

Figure1, Takeuchi et al.