



# Pterygium associated with light-emitting diode use: a case report

Fiona S. Lau<sup>1,2</sup>, Stephanie L. Watson<sup>1,3,4</sup>, Kenneth Gek-Jin Ooi<sup>2,4,5^</sup>

<sup>1</sup>Ophthalmology Department, Prince of Wales Hospital, Randwick, NSW, Australia; <sup>2</sup>Faculty of Medicine, School of Medical Sciences, University of New South Wales, Randwick, NSW, Australia; <sup>3</sup>Cornea Unit, Sydney Eye Hospital, Sydney, NSW, Australia; <sup>4</sup>Save Sight Institute, Discipline of Ophthalmology, Sydney Medical School, The University of Sydney, Sydney, NSW, Australia; <sup>5</sup>Sydney Eye Clinic, Darlinghurst, NSW, Australia  
*Correspondence to:* Dr. Kenneth Gek-Jin Ooi. Save Sight Institute, Discipline of Ophthalmology, Sydney Medical School, The University of Sydney, Sydney, NSW 2000, Australia. Email: kenneth.ooi@sydney.edu.au.

**Background:** Pterygium is a sun-related ocular surface disease secondary to ultraviolet (UV) radiation exposure. Outdoor occupational UV exposure is known to occur secondary to sun exposure. We present a unique case of pterygium associated with indoor occupational light-emitting diode (LED) exposure not previously described in the literature.

**Case Description:** A mobile phone repairer presented with blurred vision and a superotemporal pterygium of his dominant left eye associated with a magnifying glass LED work lamp was diagnosed. This was excised routinely with conjunctival autografting to the defect. Histopathology confirmed benign pterygium and recovery was uncomplicated with resolution of blur.

**Conclusions:** The development of pterygium in our patient may have arisen due to the LED lamp's wavelengths possibly falling within the UV as well as the upper end of the visible light radiation spectrum. Given the increasing reliance on LED light sources in modern life, ocular conditions arising from exposure to these radiation sources may now need to be listed in the differential diagnoses of patients with pterygium. Appropriate UV protection counselling for these types of lights may also now need to be considered.

**Keywords:** Pterygium; light-emitting diode (LED); ultraviolet light damage; ocular surface disease; case report

Received: 20 February 2022; Accepted: 01 June 2022; Published: 15 December 2022.

doi: 10.21037/aes-22-8

View this article at: <https://dx.doi.org/10.21037/aes-22-8>

## Introduction

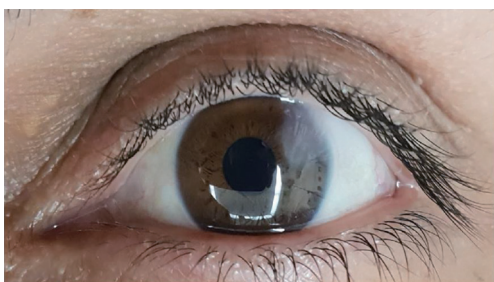
It is well-known that pterygium is a sun-related ocular surface disease of focal fibrovascular proliferation of the conjunctival tissue onto the cornea secondary to ultraviolet (UV) radiation exposure (1,2). Occupational exposure to UV radiation in the outdoor setting, via sun exposure, has been documented in the literature (3,4). Indoor occupational exposure to artificial sources of UV radiation, include welding arcs, are thought to induce ocular surface damage (4). Although other seemingly innocuous UV radiation sources are used in the indoor occupational setting (such as UV lamps), such sources have not been established as causes of ocular surface damage. We report a unique case of pterygium presumably associated

with occupational light-emitting diode (LED) exposure not hitherto described, in accordance with the CARE reporting checklist (available at <https://aes.amegroups.com/article/view/10.21037/aes-22-8/rc>).

## Case presentation

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and the accompanying image. A copy of the written

<sup>^</sup> ORCID: 0000-0001-8060-9374.



**Figure 1** Slit lamp photograph of the left eye in primary position showing the supertemporal pterygium encroaching towards the pupil margin.

consent is available for review by the editorial office of this journal.

A 38-year-old man, employed as a mobile telephone repairer, was referred by his general practitioner with a suspected pinguecula in his left eye. He had noted slight vision disturbance on extreme left-gaze. Other than a recent infected insect bite above the left eyebrow 4 months prior, which was successfully treated with topical antibiotic ointment, he had no significant past ocular history. His medical history included gastro-oesophageal reflux and depression, managed with esomeprazole and fluoxetine, respectively.

The patient used an LED magnifying glass lamp directed from the temporal aspect of his left dominant eye, over an average of 30 hours per week for 16 months, to carry out precision mobile telephone repairs. He did not wear any occupational eye protection. The lamp was a Reichelt Elektronik LL ZD-2012B-2H 100 mm desk magnifying white glass lamp, which consisted of a glass lens with 3 dioptres, 1.75× magnification, with white LEDs arranged in a ring-shaped formation (5). The lamp had a colour temperature of 6,400 Kelvin (K) (5). He did not wear any occupational eye protection. The patient did not have a history of activities associated with beyond normal Australian sunlight exposure, such as surfing or truck-driving. There was no evidence of other ocular disorders such as trauma or chemical burn. Prior to mobile telephone repairs, his previous work was in warehouse logistics and did not involve use of UV lamps.

The patient's visual acuity was 6/3.8 and intraocular pressures were 12 mmHg, both in each eye. Examination revealed a pterygium extending 4.25 mm radially into the cornea and with a base of 1.75 mm. It was triangular-shaped, located at the superotemporal aspect of the left eye

(Figure 1), and just encroaching on the pupil margin with Ilse de Fuchs present at the apex. The rest of the ocular examination was within normal limits.

Bowman's probe test in the operating room excluded pseudopterygium by the inability to pass a squint hook freely underneath the body of the primary pterygium. An excisional biopsy of the pterygium was performed, with conjunctival auto-grafting. On histopathology, conjunctival tissue with mild chronic inflammation, solar elastosis and focal haemorrhage was seen; in keeping with the diagnosis of a benign pterygium. The patient was pleased with his uncomplicated recovery, retention of pre-operative visual acuity, resolution of the vision disturbance on extreme left-gaze and no pterygium recurrence at 2-year post-operative review.

## Discussion

It is well reported that pterygium is a form of 'ophthalmoheliosis' that most commonly affects surfers and truck drivers (1). 'Heliosis', from Greek, refers to sun exposure and 'ophthalmoheliosis' are a group of ocular conditions arising from sun exposure. UV-A and UV-B radiations fall within the wavelengths of 315–400 nm and 280–315 nm respectively (6). UV-A and UV-B radiation are considered harmful and contribute to the pathogenesis of ocular surface and ocular media conditions including pterygium, pinguecula, and cataracts (6).

Our case of pterygium presumably associated with LED highlights the potential risks from either artificial source of UV LED radiation (7), or visible light radiation spectrum. The characteristics of UV radiation, including colour temperature and wavelength, are important features in the pathogenesis of pterygium (8).

The wavelengths of UV radiation are between 280–400 nm, and wavelengths of visible light are between 400–780 nm (6). Based on the principles of black body radiation, colour temperature is associated with a spectrum of wavelengths emitted by the black body radiation. The peak wavelength of the lamp, calculated using Wien's displacement law and based on colour temperature of 6,400 K, was 450 nm. Thus, a wavelength of 450 nm falls just outside of UV radiation, within the visible light spectrum.

Short-wavelength (blue) LED light (464 nm) irradiation has also been reported to result in oxidative stress, activation of autophagy, and cell death (9). An *in vivo* mouse model has demonstrated that corneal epithelial apoptosis can be induced by blue LED exposure from the light source

located 45 cm above them (10). Increased reactive oxygen species production, mitochondrial membrane damage and cell death in an immortalized human corneal epithelial cell line were also observed with blue LED light (10). The development of pterygium in our patient may thus have arisen as a result of the lamp's wavelengths partially falling within the UV as well as the higher frequency violet end of the visible light radiation spectrum.

Occupations with considerable exposure (regarded as 38 hours per week) to sources of artificial UV radiation include watchmakers and welders (4). As our mobile phone repairer patient worked an average of 30 hours per week for 16 months with this LED lamp, his risk profile may warrant inclusion on this list.

Given the increasing reliance on LED light sources in modern life, ocular conditions arising from exposure to these radiation sources may need to be listed in the differential diagnoses of patients with pterygium. Appropriate UV protection counselling for these lights may also now need to be considered. As this is the first single observational case study to report on the potential harmful effect of LED emitted wavelengths, further case series studies, as a minimum, are needed to confirm this finding as causative.

## Acknowledgments

*Funding:* None.

## Footnote

*Reporting Checklist:* The authors have completed the CARE reporting checklist. Available at <https://aes.amegroups.com/article/view/10.21037/aes-22-8/rc>

*Peer Review File:* Available at <https://aes.amegroups.com/article/view/10.21037/aes-22-8/prf>

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <https://aes.amegroups.com/article/view/10.21037/aes-22-8/coif>). KGJO serves as an unpaid editorial board member of *Annals of Eye Science* from December 2021 to November 2023. SLW is supported by a Sydney Medical School Foundation fellowship. The other author has no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and the accompanying image. A copy of the written consent is available for review by the editorial office of this journal.

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doi: 10.21037/aes-22-8

**Cite this article as:** Lau FS, Watson SL, Ooi KGJ. Pterygium associated with light-emitting diode use: a case report. *Ann Eye Sci* 2022;7:38.