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Commercial visible-light protecting sunscreens for photosensitive individuals

Dear Editor, Photodermatoses are conditions associated with heightened skin sensitivity to ultraviolet (UV) radiation and/or visible light (VL). For example, VL sensitivity may be a feature of conditions such as solar urticaria, chronic actinic dermatitis and the cutaneous porphyrias. There is generally no cure for these diseases and few effective pharmaceutical interventions.¹ The mainstay management approach is light avoidance or physical protection from the triggering wavelengths.² Sunscreen is a form of physical protection, although most sunscreens are not formulated to protect against visible wavelengths, which require VL-blocking pigments.

In the 1970s a range of reflectant sunscreens was developed in Dundee by Dr Tom MacLeod, to provide protection against visible wavelengths.^{3,4} Known as 'Dundee creams', the tinted sunscreens are available in coral pink, beige and coffee colours, and are available only in the UK and on prescription. In a 2001 study, Dundee creams demonstrated *in vitro* photosensitivity protection factor (PPF) to a broadband (UV and VL) xenon arc lamp of 9.6, 5.4 and 8.6 for coral pink, beige and coffee, respectively and, in a limited number of patients with photodermatoses, the median derived protection factor at 430 nm (blue light) was 8. These protection factors were favourable when compared with E45 Sun sunscreen (Reckitt Benckiser, Slough, UK), which had an *in vivo* median 430-nm protection factor of 2.⁴

Although Dundee creams provide protection against visible wavelengths, they do not provide optimal protection against UV and they are not available commercially. This can present logistical difficulties, including challenges with availability and prescribing through primary care, for patients with photodermatoses. Recently, the commercial sunscreen market has seen an increase in tinted sunscreens with claims of VL protection.^{5,6} This presents an ideal opportunity to

widen the availability of VL protection products for patients with photosensitivity.

We investigated a limited range of commercially available VL-protecting sunscreens to determine if they might be appropriate for photosensitive individuals. We examined the three Dundee creams, a non-VL-protecting sunscreen (Anthelios Dry Touch Gel-Cream; La Roche-Posay, London, UK), and six VL protection sunscreens with sun protection factor (SPF) 50+ (Anthelios Mineral One light, medium, tan, brown and dark brown and Anthelios Pigment Correct).

Each sunscreen was applied onto three polymethyl methacrylate (PMMA) plates (Molded PMMA plate HD6; Helioscreen, Creil, France) using a robot (HD-SPREADMASTER; Helioscreen) at a rate of 1.3 mg cm⁻². After 30 min of drying in the dark at 26 °C, PMMA plates were irradiated with an exposure dose calculated according to ISO 24443 using a UV simulator (LS1000; Solar Light, Glenside, PA, USA).⁷ After exposure, the percentage of transmittance was measured from 290 nm to 800 nm using a UV-VIS spectrophotometer (UV-2600; Shimadzu, Kyoto, Japan). Six measurements were performed on each plate and the mean calculated. A PMMA plate with glycerine was used to remove substrate contribution. Data were analysed to determine the '*in vitro*' SPF and PPF, and the percentage of VL (400–469 nm) attenuated.^{4,5} (The data are available on reasonable request to the corresponding author.)

Results showed that the commercially available VL-protecting sunscreens had lower transmission above 390 nm than did the Dundee cream beige and coral pink, and similar transmission to that of the Dundee cream in coffee. The percentage of VL (400–469 nm) attenuated was similar between the Dundee cream coffee and the commercial VL-protecting sunscreens, although the PPF was higher for the commercial sunscreens because of their higher UV protection (Table 1).

The PPF of the Dundee creams in this study was lower than those reported by Moseley *et al.*,⁴ which may be due

Table 1 Characteristics of measured sunscreens

Product name	' <i>In vitro</i> ' SPF (290–400 nm)	' <i>In vitro</i> ' PPF (290–600 nm)	% VL stopped from 400–469 nm
Anthelios Mineral One dark brown	50+	9.0	84
Anthelios Mineral One brown	50+	8.6	82
Anthelios Mineral One medium	50+	8.3	79
Anthelios Mineral One tan	50+	8.2	78
Anthelios Mineral One light	50+	7.7	76
Anthelios Pigment Correct	50+	6.9	74
Dundee cream coffee	13.0	6.8	82
Dundee cream beige	6.0	3.6	63
Dundee cream coral pink	5.4	3.6	64
Anthelios Dry Touch Gel-Cream	50+	3.0	20

SPF, sun protection factor; PPF, photosensitivity protection factor; VL, visible light.

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to use of different sunscreen concentrations (2 mg cm⁻² in Moseley *et al.*). Follow-up investigations are under way to determine the *in vivo* PPF of the commercial sunscreens and to seek patient feedback on factors such as cosmetic acceptability. Other commercially available sunscreens claiming VL protection are available, although it should not be assumed that all 'tinted' sunscreens provide VL protection.⁵ It would be important to undertake a similar analysis of other products, prior to recommending them for use in patients with VL sensitivity.

Our data suggest that the Anthelios Mineral One range and Anthelios Pigment Correct are likely to provide at least as good if not better protection than Dundee Creams for individuals with photodermatoses. This advance in commercially available VL protection is of immediate practical importance, particularly for patients with erythropoietic protoporphyria and solar urticaria as they experience intense symptoms of pain, burning, itch and urticarial rash or phototoxic erythema within seconds to minutes of even minor VL exposure. This can have a severe adverse impact on quality of life and lead to vitamin D deficiency and withdrawal from social activity during daylight hours. Treatment options are limited and expensive, and therefore commercially available products with improved VL protection could dramatically improve the lives of patients with these conditions by raising their exposure thresholds, and consequently this is a most exciting development for people living with these challenging diseases.

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Conflicts of interest: M.J., R.T. and P.R. are employees of L'Oréal, who produce and supply the Anthelios sunscreen range. The remaining authors declare they have no conflicts of interest.

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