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1 **Short term exposure to blue light emitted by electronic devices does not worsen melasma**

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41 **Sir**, Blue light from sun exposure is able to induce a potent and long-lasting
42 hyperpigmentation in dark skinned individuals ^{1,2}. Melanocytes sense directly these
43 wavelengths through the activation of a specific sensor called OPSIN-3 ³. The face is
44 regularly exposed to blue light emitted by screens of devices such as cell phones, computers
45 or televisions. This blue light typically covers a spectrum from 420 to 490nm with a peak
46 emission between 440 and 460nm depending on the source. Questions regarding the impact of
47 these devices on skin pigmentation have been logically raised as, although having low
48 intensity, the cumulative doses of blue light emitted by these screens reach the dose
49 demonstrated to induce hyperpigmentation. However, the irradiance of the light has profound
50 impact on its biological effects and the duration for achieving the dose capable of inducing
51 pigmentation is significantly longer with devices than with sun exposure ⁴. Nonetheless, in
52 melasma the skin is more sensitive to external triggers and blue light emitted by sun rays has
53 been shown to promote relapses⁵. We wished to determine whether short term exposure to
54 blue light from electronic devices would impact melasma.

55 We conducted a prospective randomized comparative intra-individual study in 12 melasma
56 patients. First, we measured the intensity of light (between 420 to 490nm) emitted by several
57 devices with the spectroradiometer sensor placed at 20cm, (10cm for cell phone) Compared to
58 sunlight in the same spectrum, the intensity is 100 to 1000 times less (Table 1). One side of
59 the face was randomly selected to receive blue light at 0.864 J/cm² (delivered in 30 minutes)
60 produced by a xenon solar simulator filtered to emit the same spectrum as device screens.
61 This is equivalent to an 8-hour exposure to the most powerful screens, which emit
62 30μW/cm². Patients were exposed daily for 5 consecutive days on one side of the face; the
63 opposite side was protected with an opaque cover maintained in place by adhesive tapes. The
64 main evaluation criterion was colorimetric comparison between the two sides at D1, D5 and

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65 D15. An evaluator, blinded to the side exposed, performed a modified MASI (Melasma Area
66 and Severity Index) for each half face. Experimental setup is detailed in supplementary files.
67 Ten patients were Fitzpatrick skin type III and 2 were skin type IV (mean age 41, range 30-
68 58). Population characteristics are described in supplementary table 1. All patients completed
69 the study. No significant difference in delta ITA (individual topology angle) was observed
70 between exposed and non-exposed sides and there was no evolution over time (Figure 1).
71 Additionally, there were no differences in delta L* (skin lightness), a* (redness) and b*
72 (yellowness), delta E (difference between lesional and non-lesional skin in each side of the
73 face) and mMASI scores (Supplementary Figure 1).
74 These results suggest that at 20 cm distance, a maximized use of a high intensity computer
75 screen for 8 hours per day over a five-day period does not worsen melasma lesions. Although
76 it is very unlikely that similar exposure over a longer period would start to impact melasma
77 lesions, such a possibility cannot be ruled out.

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93 prospective randomized comparative trial. *Journal of the American Academy of Dermatology*
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98 **Tables**

99 **Table 1: Comparison of intensity of light emitted by devices and by the sun**

100 Intensity of light between 420 and 490nm measured for several devices and compared to sun
101 intensity in the same wavelengths. The sensor of the spectroradiometer was placed at 20 cm
102 of the screen (excepted for the cell phone).

103

104

Source	Intensity $\mu\text{W}/\text{cm}^2$	Intensity mW/cm^2	Ration intensity sun/device
Sun	7700	7.7	-
TV LED (Philips 55POS9002)	78	0.078	99
Laptop LED N°1 Inspiron 17 (DELL)	7.2	0.0072	1069
Laptop LED N°2 Inspiron 24 (DELL)	15	0.015	513
Computer screen Samsung P2270H	22	0.022	350
Cell phone (at 10cm) Samsung SG7	11	0.011	700

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107 **Figures**

108 **Figure 1. Delta ITA (individual topology angle) evolution**

109 ITA is colorimetry parameter inversely correlated to pigmentation. The measure of ITA
110 during the 5 days of exposure and after 1 and 2 weeks, shows no significant variation
111 compared to baseline ITA and no significant differences between exposed and non-exposed
112 half part of the face.

113

Delta ITA as a function of time (mean \pm sem)

