Canfield Reveal Image changes following sun exposure

Alexa Carboni, BS,[a] Jessica Marie Kirk, BS,[a] Nathaniel Marroquin, BS,[a] Garrett Furth, BS,[a] James M. Small, MD, PhD,[a,b] and Robert P. Dellavalle, MD, PhD, MSPH[c,d]

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INTRODUCTION

Chronic sun exposure causes UV damage and sunburn and can lead to solar-induced aging and skin cancers.[1] Many people are unaware of the cumulative nature of sun damage and do not apply enough sunscreen for adequate protection.[2] The goal of our study is to use the Canfield Reveal Imager to conduct a qualitative case study comparing a subject's before and after photos of sun exposure to determine if acute sun exposure is enough to induce UV-related changes in the skin. According to the Environmental Protection Agency, the average UV forecast ranking of >6 calls for high UV exposure risk for patients not wearing adequate sun protection.[3,4] This study is important because it can be used for patient education regarding how the sun can damage skin even with short-term exposure.[5] Demonstration of existing UV damage and potential changes within a brief period, could lead to increased sun protective behaviors in high-risk populations and prevention of future damage reducing the risk of developing skin cancers.[6,7]

METHODS AND MATERIALS

One subject with Fitzpatrick skin type III was studied and instructed to expose facial skin for at least 6 consecutive hours without sunscreen, topical products, or any external barrier throughout the study period and during data collection with the Canfield Reveal Imager. The Canfield Reveal Imager is a tool conventionally used by dermatologists to provide images of patients to discuss aesthetic treatments. The camera is accompanied by an apparatus that stabilizes the patient's face to ensure comparable images are captured for the RBX software to create a cross-polarization photo that eliminates specular reflections on the skin surface to improve visibility of small details. The software then creates red/brown filtered images, emphasizing both hyperpigmented and vascular spots.[8] Subject laid by a pool for 2 hours before electively wearing a hat for the remaining 4 hours of the study due to discomfort. The hat worn was a baseball cap that provided shade to the face without allowing sunlight to filter through. The preexposure photos (Fig 1, left column) and postexposure photos (Fig 1, middle column) were collected in Englewood, Colorado on September 18, 2022. One week postexposure photos (Fig 1, right column) were collected on September 25, 2022. The weather forecast on September 18, 2022, was sunny and 83° F with a UV index of 7 during the study. Before exposure photos were taken at 11 AM, and after exposure photos were collected 6 hours later, immediately after the time course. The Canfield Reveal imager collected the following 3 different types of images per session: (1) the polarized photo, (2) "brown spots" photo focusing on the concentration of melanin within the epidermis, and (3) "red spots" photo, which visualizes vascular changes within the dermis. The participant returned 1 week later for a third session of photos to evaluate differences after inflammation, and after the sunburn had subsided. Subject resumed normal activities after exposure to SPF 30 application

From Rocky Vista University, College of Osteopathic Medicine, Parker, Colorado[a]; Department of Biomedical Sciences, Rocky Vista University, College of Osteopathic Medicine, Parker, Colorado[b]; Department of Dermatology, University of Colorado Anschutz Medical Campus, Aurora, Colorado[c]; and Dermatology Service, US Department of Veterans Affairs Rocky Mountain Regional Medical Center, Aurora, Colorado.[d]

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Correspondence to: Jessica Kirk, BS, Rocky Vista University College of Osteopathic Medicine, 8401 S. Chambers Rd, Greenwood Village, CO 80112. E-mail: Jessica.kirk@co.rvu.edu.

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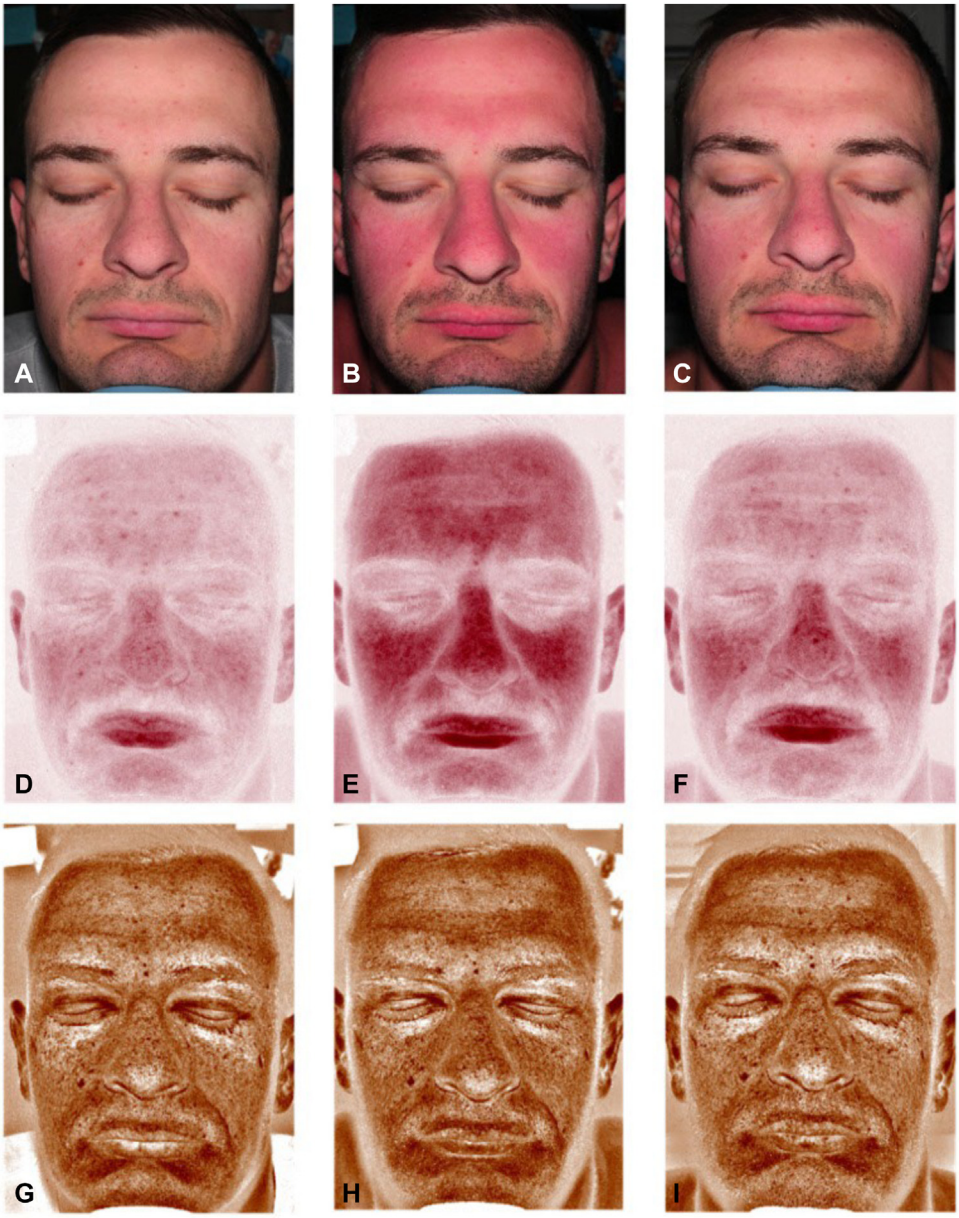

Fig 1. Preexposure (left column: photos: A, D, G), immediate postexposure (middle column: photos: B, E, H), and 1-week postexposure (right column: photos: C, F, I) photos showing polarized (first row photos: A-C), "red spots" (second row photos: D-F), and "Brown Spots" (third row photos: G-I).

daily and reported working in a setting without natural light. Subject also did not partake in any outdoor activities immediately and 1 week after postexposure period. Analysis was completed by the study researchers via visual comparison of the preexposure photos and 1-week postexposure photos since the Canfield Imager does not contain image quantifying software.

Consent for the publication of all patient photographs and medical information was provided by the authors at the time of article submission to the journal stating that all patients gave consent for their photographs and medical information to be published in print and online and with the understanding that this information may be publicly available.

RESULTS

There were 3 different occasions of photos collected of the participant as follows: (1) preexposure (Fig 1, left column), (2) immediate

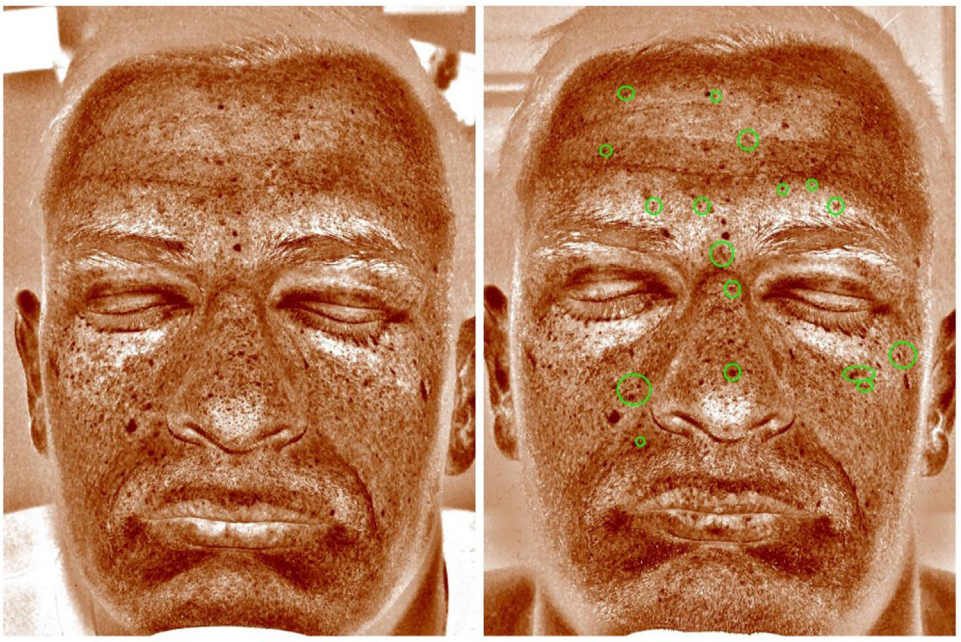

Fig 2. Preexposure "Brown Spots" photo (left) in comparison with 1-week postexposure photo (right) with newly identified brown spots (*green circles*).

postexposure (Fig 1, middle column), and (3) 1 week postexposure (Fig 1, right column). When comparing the left column to the middle column, it is apparent that the subject shows acute sunburn. In Fig 1, the "red spots" images show dense collections of vascular changes, most notably at the malar cheeks, lips, and forehead in the immediate postexposure photo. When comparing the left column to the right column, there are notable differences in the "brown spots" photos in the superior margins of the forehead and nasal saddle with increased hyperpigmentation. In Fig 2, preexposure (left) was compared with 1-week postexposure (right) photo with newly developed "brown spots" circled in green. Fig 2 displays qualitative information indicative of the impact of acute sun exposure on the increased incidence of new "brown spots."

DISCUSSION

Each image shows differences when comparing the before and after photos. There was no supervision during the subject's sun exposure, leaving the subject open to electing whether to seek shade during the study. Though an increase in the number of new brown spots was detected, this was seen as a limitation of the study since total time of direct sun exposure was altered. However, this study shows that acute exposure can increase the number of brown spots accumulated. It would be beneficial to see these acute changes in a future study to look at each hour of exposure or incorporate different imaging modalities with quantitative analysis. The Canfield Reveal Imager has been traditionally used to assess rhytids, rosacea, and telangiectasias. However, this study supports a new-use case for patient education and establishes a visual representation of what changes occur during UV sun exposure.[9,10] This imaging modality has not been incorporated in longitudinal studies to see the impact of sun exposure over months to years. Both a limitation and a novel visual representation, this study presents information for both providers and patients to see the impact of acute exposure; it would be informative to compare this subject's Canfield Reveal Imager photos at a further time point to assess the chronic exposure changes such as 6 months, 1 year, etc.

CONCLUSION

The study assigned 6 hours as the total duration of sun exposure; however, it was apparent that even 2 hours of exposure can show a qualitative change in brown spot acquisition and pigmentation concentration, which is the body's endogenous protection via melanin production. Using the Canfield Reveal Imager can show acute skin changes after direct exposure for just 2 hours and indirect exposure for 4 hours. Our results show that imaging modalities like the Canfield Reveal Imager can be incorporated in dermatology clinics during patient visits or this

study can be used to demonstrate sun exposure–related changes to the skin when counseling patients regarding skin safety.

Conflicts of interest

Dr Dellavalle is a member of the Colorado Skin Cancer Task Force. Authors Carboni, Kirk, Marroquin, Furth, and Small have no conflicts of interest to declare.

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