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Standardized clinical photography considerations in patients across skin tones

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Reliable, standardized photos are critical in dermatology for patient care, documentation, education and longitudinal disease monitoring. However, despite the use of high-quality equipment and standardized methods, obtaining reliable photos for erythematous skin conditions is challenging, especially for patients with darker skin (IV, V or VI on the Fitzpatrick scale).[1] Patients with skin of colour (SOC) comprise heterogeneous racial and ethnic groups with wide-ranging skin hues including Black/African American, East and South Asian, Native American, Hispanic ethnicity, and those with mixed racial and ethnic backgrounds. Higher density of melanin in these patients leads to an increase in background competing chromophores in photography, interfering with accurate depiction of the overlying erythema.[2] This issue originates from the time when colour photography was first introduced, when Kodak's Shirley card, an image of a white woman, was the standard colour calibration tool.[1,3] Advancements in digital technology, including dual skin-tone colour-balancing capabilities and image stabilization, have addressed many issues, but capturing detailed features of darker skin and erythema still remains a challenge.[1]

A recent article by Lester *et al.* outlines the best practices and techniques for accurate capture of skin lesions in patients with SOC, including the use of cross-polarized light.[1] Cross-polarized light photography is performed using two polarizers placed perpendicularly, one on the lens and another on the light source, eliminating specular reflections from the skin. Whereas nonpolarized (white) light enhances superficial skin texture and structures, cross-polarized light allows back-scattered light from deeper levels of the skin to reach the eye or camera, thereby enhancing visualization of subsurface structures including underlying blood vessels and chromophores.[2,4] Cross-polarized light enables more objective characterization of skin colour and has been utilized to assess colour changes in various conditions including inflammatory dermatoses, ecchymosis and acne.[2,4]

In dermatology, cross-polarization is the primary technique behind polarized dermoscopy to visualize deeper dermal structures and birefringent structures such as collagen (white streaks).[2] Outside of dermatology, its applications span diverse fields including dentistry, forensics and astronomy.[2] Advantages of cross-polarized photos apply to patients with all skin types, but especially for patients with SOC, whose high density of melanin in the skin interferes with visualization of rash or erythema via photography.

In this article, we show representative examples of cross-polarized and white-light clinical photos taken 1 minute apart, illustrating the advantages and general pitfalls of cross-polarized photos in visualizing various types of rash in patients with SOC based on our experience at Memorial Sloan Kettering Cancer Center (Figure 1). We also provide practical guidance for use of cross-polarized photography in clinical practice. In our institution, both cross-polarized and white light are now routinely used to capture all patients with inflammatory lesions and those undergoing three-dimensional total-body photography for clinical or research purposes. This is a recent institution-wide practice that was implemented to improve rash visualization, particularly in this patient population.

As mentioned, the major advantage of cross-polarization is the significant reduction in specular reflections, which translates to (i) decrease in glare, (ii) enhancement of erythema and (iii) increased contrast of the lesion to the underlying skin (Figure 1). This is particularly useful for clinical assessments of patients with SOC who heal with hyperpigmentation. Cross-polarized photos allow the viewer to better distinguish between an active lesion and an inactive, healed lesion with postinflammatory hyperpigmentation.

One pitfall is the reduced ability to differentiate lesion morphology (e.g. flat vs. raised) compared with white-light photos. In cases like mycosis fungoides where the lesion morphology (patch vs. plaque) has a clinical prognostic value, a cross-polarized photo alone is insufficient for accurate capture. Another pitfall is the increased amount of shadow in some areas of cross-polarized photos.

Cross-polarized photos can be obtained using a circular polarizer on the DSLR camera lens and a linear polarizer on the flash oriented downwards at 45°, as previously reported by O'Sullivan *et al.*[4] Use of smartphones for mobile and inexpensive cross-polarized capture has also been reported.[5] When available, authors recommend use of cross-polarized photos to complement standard clinical photography when documenting erythematous lesions in patients with SOC. The improved visualization and more representative photos obtained via cross-polarized photography can be highly beneficial in various settings: clinical comparison of disease progression (e.g. clinical trial patients, chronic disease), interprofessional communication (photo sharing), scientific publication and education.

In conclusion, cross-polarized lighting improves colour contrast when imaging patients, which is especially helpful in assessing active erythema and inflammation in the population of patients with SOC. Because it decreases surface reflection, it may also decrease the ability to interpret texture and lesion

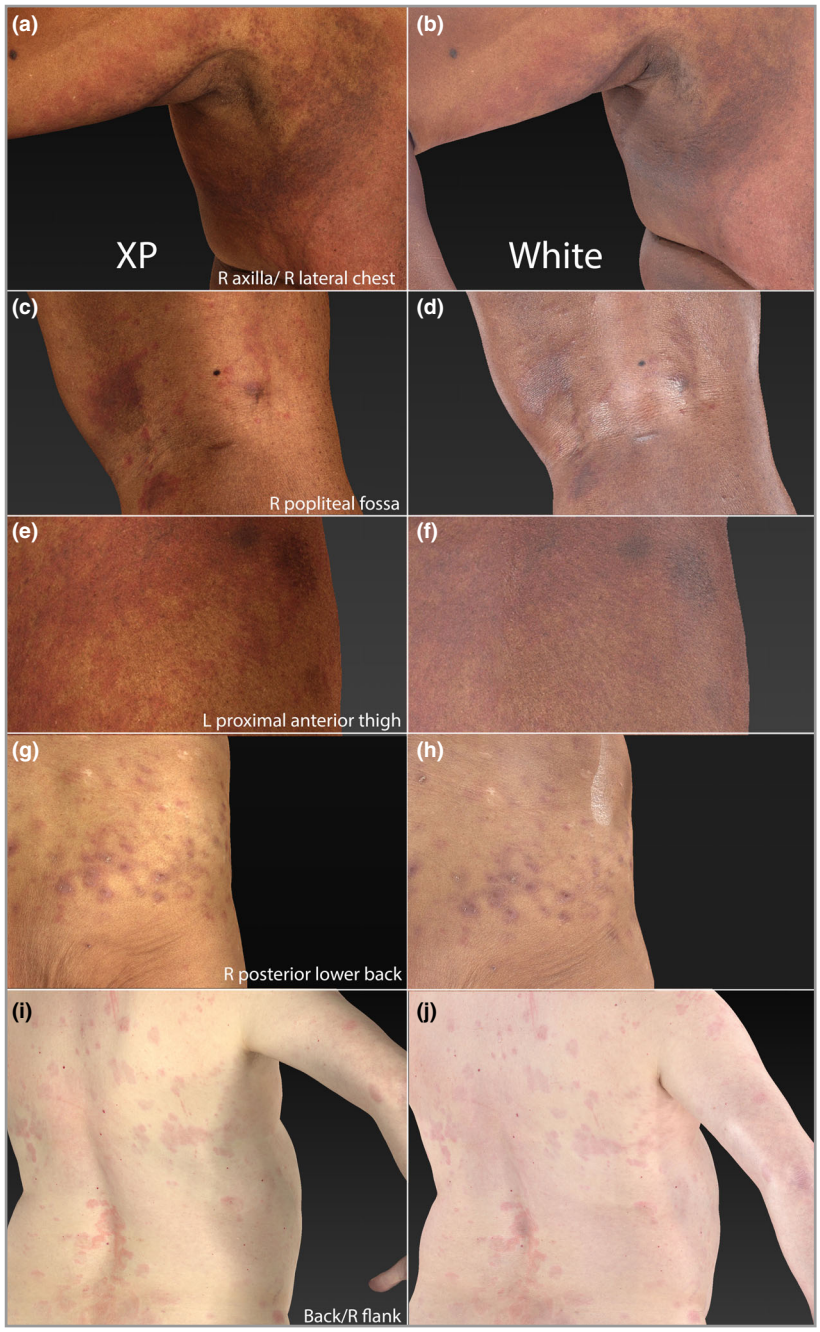

Figure 1 Comparison of cross-polarized (XP, left) and white-light (right) photos of patients with Fitzpatrick skin types V (a–f), IV (g, h) and II (i, j) obtained using three-dimensional total-body photography. All patients had generalized rash as an immune-related cutaneous adverse event attributed to checkpoint inhibitors. XP photos eliminate the glare present in white-light photos and highlight erythema. Erythema is less visible particularly in darker skin tones with conventional white-light photography (b, d, f, h) compared with lighter skin tones (j). No adjustments were made to the images other than insertion of labels and cropping of images. Anatomical locations are labelled R, right; L, left.

morphology. The authors recommend use of both white and cross-polarized light for clinical photography when available.

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