TECHNOLOGY IN DERMATOLOGY OPEN ACCESS

Dermoscopy of Scabies: Utility of Polarised and Ultraviolet-Induced Fluorescence Examination in Fair and Dark Skin

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Received: 6 April 2024 | **Revised:** 1 December 2024 | **Accepted:** 17 December 2024

Funding: The authors received no specific funding for this work.

Keywords: diagnosis | differential diagnosis | scabies | skin of colour | UV

ABSTRACT

Introduction: Ultraviolet-based dermoscopy may support the recognition of scabies, yet neither accuracy analyses nor data on skin of colour are available. The aim of this multicentric observational retrospective was to investigate the diagnostic accuracy of polarised and ultraviolet-induced fluorescence (UVF) dermoscopic examination in both fair and dark skin, also assessing possible differences according to the skin tone.

Methods: Consecutive patients with a diagnosis of scabies were eligible. All the images were randomly evaluated by two independent experienced investigators to identify scabietic findings reported in the literature. Interobserver agreement was evaluated for both polarised and UVF dermoscopic pictures through Cohen's kappa coefficient, while Fisher's exact test with p-value set at 0.05 was used for comparative analyses between the two settings.

Results: A total of 97 lesions from 43 patients (21 with fair skin and 22 with dark skin) were included. The comparative analysis highlighted a superiority of UVF dermoscopy to detect the burrow ($p = 0.003$) and scabietic eggs ($p = 0.012$) in skin of colour, while polarised dermoscopy was more accurate to show the mite in fair skin ($p = 0.042$). Additionally, a general higher accuracy of both settings in light phototypes was also found, with a higher prevalence ($p < 0.05$) of typical scabietic findings (i.e., serpiginous white tract, 'triangle' sign and grey-brown outlines of the burrow for polarised dermoscopy and green dot for UVF dermoscopy) compared to dark skin. Kappa values were 0.87 and 0.83 for polarised and UVF-dermoscopy, respectively.

Conclusions: UVF dermoscopy improves the recognition of scabies, though it should be considered complimentary to polarised light dermoscopic examination to increase diagnostic performance.

Enzo Errichetti and Noemi Plozner qualified as first author.

1 | Introduction

The use of dermoscopy has significantly enhanced the diagnostic accuracy of scabies in daily clinical practice, as it has been shown to promptly facilitate the identification of mites and burrows and guide skin sampling for microscopy [1]. Nevertheless, although dermoscopic assessment has been found to be more sensitive than microscopic observation following naked eye-based scraping or the adhesive tape test [1], there remains a significant number of cases in which dermoscopy does not reveal scabietic findings [2]. Additionally, there is a lack of data on the accuracy of this technique in diagnosing scabies in dark-skinned populations, where diagnosis may be more challenging due to the darker background [3], as has been demonstrated for other dermatoses [4–6]. It is noteworthy that there is growing evidence suggesting that ultraviolet-based dermoscopy might improve the recognition of scabies compared to polarised light-based dermoscopy [7, 8], although neither accuracy analyses nor data on skin of colour are available. The aim of the present study was to investigate the diagnostic accuracy of polarised and ultraviolet-induced fluorescence (UVF) dermoscopy in both fair and dark skin, with a focus on analysing possible differences according to skin tone.

2 | Main Text

This was a multicentric observational retrospective analysis involving seven dermatological centres from Italy (Udine and Trieste), India (Srinagar), Nigeria (Nnewi), Gambia (Banjul) and Poland (Katowice and Poznań). Consecutive patients with scabies diagnosed according to microscopic examination or typical clinical findings/course and remission after anti-scabietic therapy were eligible. We only considered instances with availability of high-quality dermoscopic images of the target lesion (i.e., lesion from which was isolated the mite on microscopy or the most representative lesion on clinical ground) captured at 10x magnification under both UV light (dry setting) and polarised light (dry setting, with possible additional use of a fluid interface based on physician evaluation). The dermoscopy device used across all centres was the *Dermlite DL5* (San Juan Capistrano, CA, United States) coupled with a high-resolution camera or smartphone. While the centres are geographically distant and may have varying levels of physician experience, this was mitigated by the fact that two experienced investigators evaluated the images. Patients having received therapies within 8 weeks before examination was ruled out to avoid biases related to possible changes of dermoscopic patterns by treatment. Patients' age and gender were recorded. All the images were randomly evaluated by two independent experienced investigators (EE, GS) to identify scabietic findings reported in the literature [burrow (serpiginous white—polarised dermoscopy—or light blue—UVF dermoscopy—tract), mite ('triangle sign' representing the anterior part of the mite—for both polarised and UVF dermoscopy—and green point-shaped area representing the body of the mite within the burrow—only for UVF dermoscopy), scabietic eggs, mite faeces (seen as grey or grey-brown lines at the edges of the burrow, representing mite faeces containing melanin—polarised dermoscopy) and the sign of mite progression within the epidermis (visible as a pattern of wake-shaped scales, resulting from post-inflammatory scaling due to the passage of the mite—polarised dermoscopy); see Tables 1 and 2 for further details].

Interobserver agreement was evaluated for both polarised and UVF dermoscopic pictures through Cohen's kappa coefficient. Afterward, a second meeting between evaluators to reach a consensus was conducted, with the final decision to mark as present/absent based on unanimous agreement. Fisher's exact test with p-value set at 0.05 was used for comparative analyses.

A total of 97 lesions from 43 patients [19 females and 24 males; 21 with fair skin and 22 with dark skin (light phototypes: I—4, II—8, III—9; dark phototypes: IV—6, V—9, VI—7); mean age: 38.2 years] were included in the study.

In general, the commonest dermoscopic findings (≥ 50% of cases) observed on both polarised and UVF dermoscopy included the presence of the burrow (white serpiginous tract) and the mite, with a prevalence of 82.5% versus 96.9% and 68.0% versus 53.6%, respectively. Other less common features were wake-shaped scales, scabietic eggs and the mite faeces, with the last one being seen only on polarised dermoscopic examination. When it comes to comparative analysis between polarised and UVF dermoscopy, the burrow and scabietic eggs were more frequently found under UVF dermoscopic examination ($p = 0.002$), while there was no significant difference for mite evidence between the two dermoscopic settings ($p = 0.056$). However, when considering instances according to phototypes (fair vs. dark skin), the mite was more commonly observed on polarised dermoscopy in light phototypes ($p = 0.042$), whereas the burrow was easier to be detected under UVF dermoscopy in dark phototypes ($p = 0.003$). Additionally, scabietic eggs were seen only on UVF dermoscopic assessment in skin of colour ($p = 0.012$). Table 1 displays all analytical data and differences between polarised and UVF dermoscopy in general and according to skin phototype; Figures 1 and 2 show some practical examples. Kappa values were 0.87 and 0.83 ('almost perfect' agreement) for polarised and UVF dermoscopy, respectively.

Moving to the comparative analysis between fair and dark skin (Table 2), polarised dermoscopy was found to be more accurate to detect both the burrow ($p = 0.003$) and the mite ('triangle' sign) ($p < 0.001$) as well as the mite faeces ($p = 0.039$) in light phototypes. On the other hand, UVF dermoscopy performed better in fair skin only to show the mite ($p < 0.001$), especially the body of the mite within the burrow detected as a round, green structure ($p < 0.001$), whereas no significant difference was observed for other findings ($p < 0.05$). Figures 1 and 2 display some examples of light- and dark-skinned patients.

The main limitation of the study is its retrospective design, which is prone to recall and observation biases, which were addressed by involving evaluators who did not contribute to the sample collection.

3 | Discussion

Our accuracy analysis supports the usefulness of UVF dermoscopy in the diagnosis of scabies, particularly to detect the burrow (serpiginous light blue tract). This is in line with previously

TABLE 1 | Dermoscopic findings of scabies (total instances: 97 lesions from 43 patients): Comparative analysis between conventional and ultraviolet-induced fluorescence (UVF) dermoscopy in general and according to skin phototype (fair and dark skin).

	Scabies (all instances) ($n = 97$ lesions)			Scabies (fair skin) ($n = 56$ lesions)			Scabies (dark skin) ($n = 41$ lesions)		
Dermoscopic findings	**Conventional dermoscopy *N* (prevalence)**	**UVF dermoscopy *N* (prevalence)**	***p****	**Conventional dermoscopy *N* (prevalence)**	**UVF dermoscopy *N* (prevalence)**	***p****	**Conventional dermoscopy *N* (prevalence)**	**UVF dermoscopy *N* (prevalence)**	***p****
Burrow (serpiginous white tract)	80 (82.5%)	94 (96.9%)	· ***0.002***	52 (92.9%)	55 (98.2%)	· *0.364*	28 (68.3%)	39 (95.1%)	· ***0.003***
Mite	66 (68.0%)	52 (53.6%)	· *0.056*	53 (94.6%)	45 (80.4%)	· *0.042*	13 (31.7%)	7 (17.1%)	· *0.198*
Triangle sign[a]	66 (68.0%)	12 (12.4%)	· ***< 0.001***	53 (94.6%)	10 (17.9%)	· ***< 0.001***	13 (31.7%)	2 (4.9%)	· ***0.003***
Green dot[b]	0 (0.0%)	40 (41.2%)	· ***< 0.001***	0 (0.0%)	35 (62.5%)	· ***< 0.001***	0 (0.0%)	5 (12.2%)	· *0.055*
Scabietic eggs	2 (2.1%)	15 (15.5%)	· ***0.002***	2 (3.6%)	8 (14.3%)	· *0.094*	0 (0.0%)	7 (17.1%)	· ***0.012***
Grey or grey-brown lines at the edges of the burrow[c]	13 (13.4%)	0 (0.0%)	· ***0.001***	11 (19.7%)	0 (0.0%)	· ***0.001***	2 (4.9%)	0 (0.0%)	· *0.494*
Wake-shaped scales[d]	29 (29.9%)	36 (37.1%)	· *0.362*	18 (32.1%)	21 (37.5%)	· *0.692*	11 (26.8%)	15 (36.6%)	· *0.477*

[a]Brown triangular structure corresponding to the anterior part of the mite.
[b]Representing the whole mite body.
[c]They represent mite faeces containing melanin at the edges of the burrow.
[d]Resulting from mite progression within the epidermis giving rise to post-inflammatory scaling.
*p-value < 0.05 deemed as statistically significant (reported in bold; in italics we indicated all the p-values).

TABLE 2 | Dermoscopic findings of scabies (total instances: 97 lesions from 43 patients): Comparative analysis between fair and dark skin under conventional and ultraviolet-induced fluorescence (UVF) dermoscopy.

	Conventional dermoscopy			UVF-dermoscopy		
Dermoscopic findings	**Fair skin ($n=56$ lesions) *N* (prevalence)**	**Dark skin ($n=41$ lesions) *N* (prevalence)**	***p****	**Fair skin ($n=56$ lesions) *N* (prevalence)**	**Dark skin ($n=41$ lesions) *N* (prevalence)**	***p****
Burrow (serpiginous white tract)	52 (92.9%)	28 (68.3%)	· ***0.003***	55 (98.2%)	39 (95.1%)	· *0.571*
Mite	53 (94.6%)	13 (31.7%)	· ***<0.001***	45 (80.4%)	7 (17.1%)	· ***<0.001***
Triangle sign[a]	53 (94.6%)	13 (31.7%)	· ***<0.001***	10 (17.9%)	2 (4.9%)	· *0.067*
Green dot[b]	0 (0.0%)	0 (0.0%)	· *1.000*	35 (62.5%)	5 (12.2%)	· ***<0.001***
Scabietic eggs	2 (3.6%)	0 (0.0%)	· *0.506*	8 (14.3%)	7 (17.1%)	· *0.800*
Grey or grey-brown lines at the edges of the burrow [c]	11 (19.7%)	2 (4.9%)	· ***0.039***	0 (0.0%)	0 (0.0%)	· *1.000*
Wake-shaped scales[d]	18 (32.1%)	11 (26.8%)	· *0.656*	21 (37.5%)	15 (36.6%)	· *1.000*

Note: Values highlighted in bold indicate statistically significant differentiating findings.
[a]Brown triangular structure corresponding to the anterior part of the mite.
[b]Representing the whole mite body.
[c]They represent mite faeces containing melanin at the edges of the burrow.
[d]Resulting from mite progression within the epidermis giving rise to post-inflammatory scaling.
*p-value < 0.05 deemed as statistically significant (analyses performed according to Fisher's exact test).

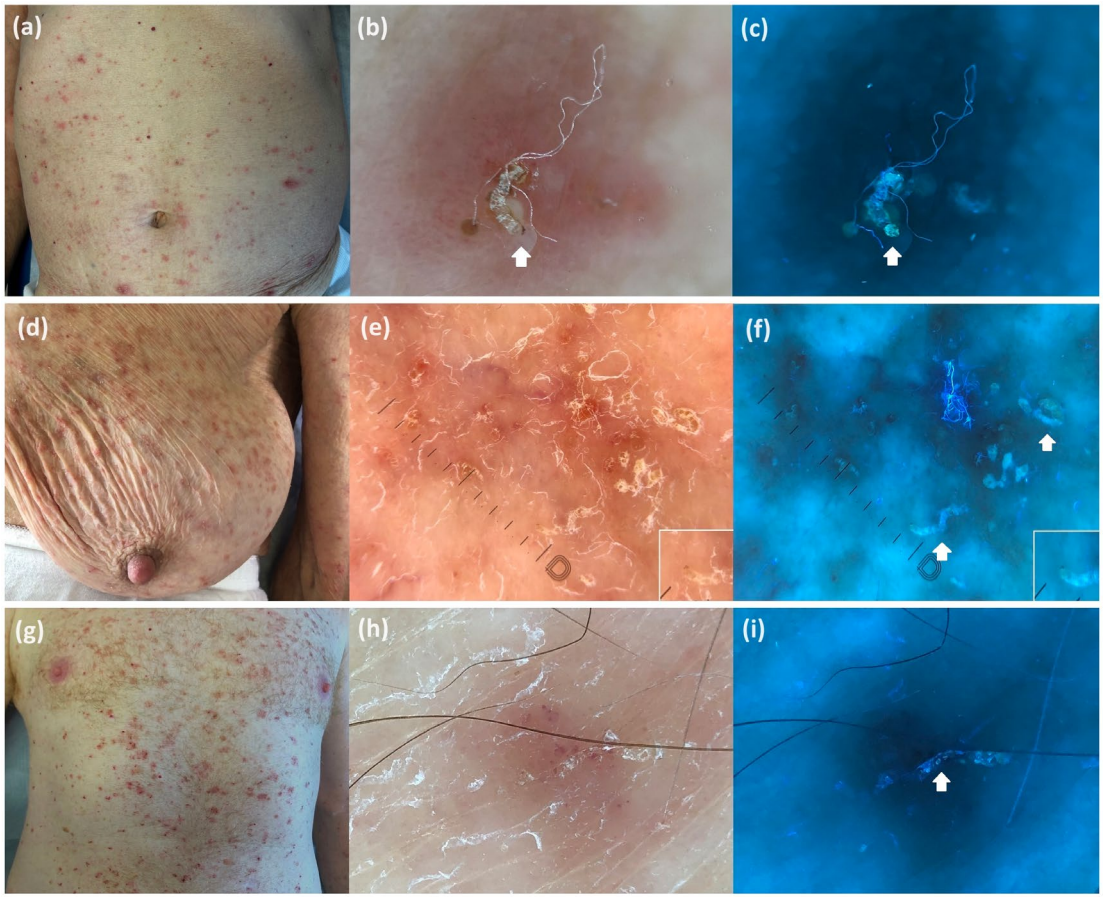

FIGURE 1 | Scabies in a Caucasian patient (phototype II): Clinical image (a); polarised dermoscopy shows the 'triangle' sign (arrow) followed by the white serpiginous tract (b); UVF dermoscopy reveals a green-dotted area (body of the mite) (arrow) as well as the light blue serpiginous tract (c). Scabies in a Caucasian patient (phototype III): Clinical image (d); polarised dermoscopy displays superficial white scaling interfering with the view of the burrows along with the 'triangle' sign (better seen in the inset) (e); UVF dermoscopy clearly shows the serpiginous light blue tracts (arrows) and the dark triangle (better seen in the inset) (f). Scabies in a Caucasian patient (phototype II): Clinical image (g); polarised dermoscopy shows unspecific scaling with no clearly recognisable burrow (h); UVF dermoscopy reveals the light blue serpiginous tract with also a scabietic egg inside (arrow) (i).

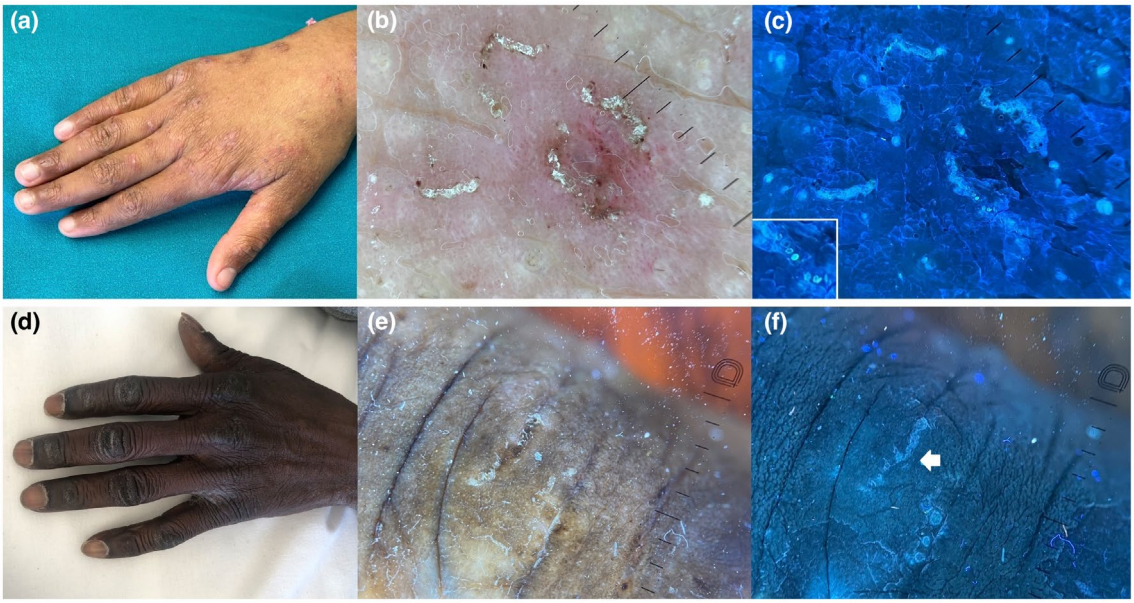

FIGURE 2 | Scabies in an Indian patient (phototype V): Clinical image (a); polarised dermoscopy displays several grey-brown triangles with burrows (b); UVF dermoscopy only reveals the burrows along with scabietic eggs inside (better seen in the inset) (c). Scabies in an African patient (phototype VI): Clinical image (d); polarised dermoscopy does not display clearly recognisable scabietic findings (e); UVF dermoscopy reveals the serpiginous light blue tract (arrow) (f).

reported studies and could be due to the better ability of UVF setting to highlight deeper epidermal findings (i.e., scabietic tunnel) and exclude interfering superficial scaling as a result of its scarce light reflection [7–10]. The same optical principle might be the reason underlying the better visualisation of scabietic eggs inside the burrow on UVF dermoscopy.

Importantly, our study also highlights a significant influence of skin tone on dermoscopic findings. Indeed, when comparing the two settings in fair and dark phototypes separately, we found the burrow to be better seen on UVF dermoscopic assessment only in skin of colour, while no difference was observed in light phototypes. On the other hand, polarised dermoscopy was more accurate to show the mite compared to UVF dermoscopy only in fair skin. Additionally, considering the comparative analysis between fair and dark skin for both polarised and UVF dermoscopy, we found a higher accuracy of both settings in light phototypes, with a higher prevalence of typical scabietic findings (i.e., serpiginous white tract, 'triangle' sign and grey-brown lines at the edges of the burrow for polarised dermoscopy and the green point-shaped area for UVF-dermoscopy). Such a variability could be due to two peculiar features of skin of colour that may impair the visualisation of some dermoscopic structures: [4–6] (I) the higher tendency to hyperkeratosis, that may compromise burrow visualisation under polarised light (but not under UVF setting) and green point-shaped area detection under UVF dermoscopy (as the body of the mite is covered by a thicker reflecting corneum layer); and (II) the presence of dark background/melanin exfoliation, resulting in a reduced optical contrast with pigmented structures (i.e., grey–brown triangle corresponding to the anterior part of the mite and the grey–brown outlines of the burrow corresponding to the mite faeces containing melanin).

In conclusion, UVF dermoscopy improves the recognition of scabies, though it should be considered complimentary to polarised-light dermoscopic examination to increase diagnostic performance.

Ethics Statement

The study was performed according to the principles outlined in the Declaration of Helsinki and the Declaration of Taipei.

Consent

Consent to publication form has been signed by the patients included in this study.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All the data are contained in the manuscript.

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