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Dermoscopy in general dermatology (non-neoplastic dermatoses) of skin of colour: a comparative retrospective study by the International Dermoscopy Society

Background: Dermoscopy has been shown to be a useful supportive tool to assist the diagnosis of several non-neoplastic dermatoses (*i.e.* inflammatory, infiltrative and infectious skin diseases), yet data on skin of colour is still limited. *Objectives:* To characterize dermoscopic features of non-neoplastic dermatoses in dark-skinned patients in order to identify possible clues that may facilitate the differential diagnosis of clinically similar conditions. *Materials & Methods:* Members of the International Dermoscopy Society were invited to submit cases of any non-neoplastic dermatosis developing in patients with Fitzpatrick Phototypes V-VI whose diagnosis had been confirmed by the corresponding gold standard diagnostic test. A standardized assessment of the dermoscopic images and a comparative analysis according to clinical presentation were performed. Seven clinical categories were identified: (I) papulosquamous dermatoses; (II) facial hyperpigmented dermatoses; (III) extra-facial hyperpigmented dermatoses; (IV) hypopigmented dermatoses; (V) granulomatous dermatoses; (VI) sclerotic dermatoses; and (VII) facial inflammatory dermatoses. *Results:* A total of 653 patients (541 and 112 with Phototype V and VI, respectively) were recruited for the analysis. Thirty-six statistically significant dermoscopic features were identified for papulosquamous dermatoses, 24 for facial hyperpigmented disorders, 12 for extra-facial hyperpigmented disorders, 17 for hypopigmented disorders, eight for granulomatous dermatoses, four for sclerotic dermatoses and 17 for facial inflammatory diseases. *Conclusion:* Our findings suggest that dermoscopy might be a useful tool in assisting the diagnosis of clinically similar non-neoplastic dermatoses in dark phototypes by revealing characteristic clues. Study limitations include the retrospective design, the lack of a direct dermoscopic-histological correlation analysis and the small sample size for less common diseases.

Key words: dark skin, dermoscopy, diagnosis, granulomatous dermatoses, inflammoscopy, inflammatory dermatoses, pigmentary skin disorders

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Dermoscopy is a fascinating bridge between clinical and histological examination that has become a key part of the dermatologist's diagnostic armamentarium due to the ability to reveal findings not visible to the naked eye [1]. Although in daily clinical practice this non-invasive technique is mainly used for the examination of pigmented and non-pigmented skin tumours, several studies have shown its usefulness also in the field of non-neoplastic dermatoses (*i.e.* inflammatory, infiltrative and infectious skin diseases) as a supportive tool to facilitate the clinical differential diagnosis, thus reducing the number of cases requiring biopsy [2-7].
The possible application of dermoscopy for non-neoplastic dermatoses has increased the popularity of this technique even in dark-skinned populations, for which it has been classically used less due to the lower incidence of skin tumours [8]. However, data on darker skin is still limited as most published studies involved Caucasian or Asian patients (generally with Phototype up to IV) [1-9]. This is a relevant issue because presentation of dermatological diseases in skin of colour (especially Phototypes V/VI) may significantly differ from that of fair skin due to the diverse background of colour and specific reaction patterns typical of darker phototypes (*e.g.* lability of pigment and greater tendency for follicular or sclerotic reactions) [10]. Additionally, there are some dermatoses that are exclusively or predominantly seen in darker skin [10] for which no data are available from published papers on lighter phototypes.
In this study, we sought to characterize dermoscopic features of non-neoplastic dermatoses in dark-skinned patients in order to identify possible clues that may facilitate the differential diagnosis of clinically similar conditions.
The study was conducted in accordance with ethical guidelines, and IRB approval was obtained.

Methods

This was a retrospective observational study launched by the International Dermoscopy Society (IDS) via an online call published on the IDS website (www.dermoscopy-ids.org). Potential participants were invited to submit cases of any non-neoplastic dermatosis, including inflammatory and infectious conditions as well as infiltrative diseases (*i.e.* non-tumoral dermatoses characterised by dense dermal cellular infiltrates or deposits) [11] developing in patients with Fitzpatrick Phototypes V-VI (assessed according to health chart records resulting from a direct evaluation of the physician), whose diagnosis had been confirmed by the corresponding gold standard diagnostic test (histology, microbiological tests or typical clinical features). Notably, according to our preliminary observations and literature data [11-15], we excluded Phototype IV as dermoscopic patterns in this group of patients are similar to those of lighter skin types, rather than Phototypes V and VI which share similar features. High quality clinical and dermoscopic pictures (captured at x10 magnification) and information on lesion localization and phototype were required. Patients under treatment at the time of image acquisition were excluded.
Two independent investigators (EE, AL), blinded to the diagnosis, evaluated the images for the presence of predefined dermoscopic criteria. In case of disagreement, a third investigator was involved (BSA). Dermoscopic variables were selected according to the recent consensus document by the International Dermoscopy Society on dermoscopy of non-neoplastic dermatoses and included five standardized basic parameters with several possible sub-items for each of them: (I) vessels (morphology and distribution); (II) scales (colour and distribution); (III) appendages findings; (IV) "other structures" (features other than vessels, scales and follicular findings) (including colour and morphology); and (V) "specific clues" (features strongly suggestive of a dermatosis due to a strict correlation with highly specific/sensitive histological findings) [12]. Importantly, the third parameter was unanimously modified compared to the original consensus paper (from "follicular" to "appendages" findings), in accordance with preliminary observations and literature data which showed the possible involvement of eccrine sweat glands in dark skin [13, 14].
For comparison purposes, the cases were classified according to predefined groups of diseases with similar clinical presentation [11], in order to investigate possible dermoscopic clues that might facilitate the differential diagnosis. Seven clinical categories were identified: (I) papulosquamous dermatoses; (II) facial hyperpigmented dermatoses; (III) extra-facial hyperpigmented dermatoses; (IV) hypopigmented dermatoses; (V) granulomatous dermatoses; (VI) sclerotic dermatoses; and (VII) facial inflammatory dermatoses. Uncommon skin diseases (for which sample size was too small for statistical comparisons) and disorders not falling into any of the previous

categories (miscellaneous) were only analysed in a descriptive way. Notably, regarding papulosquamous dermatoses, in order to reduce anatomical biases, we did not consider lesions localized on the head and palmo-plantar areas as some peculiarities in such areas may significantly affect the dermoscopic pattern of these conditions (*i.e*. thicker epidermis in palmo-plantar areas and higher density of sebaceous glands on the head) [1-14].

Statistical analysis

Absolute and relative frequencies were obtained for the dermoscopic features within each clinical category of lesions. Non-parametric Pearson's Chi Square test was used to flag differences among compared dermatoses within each category. Due to the nature of this study, a large number of observations was recorded resulting in large contingency tables, thus we compensated for the alpha inflation via the modified Bonferroni test, as suggested by Keppel [16]. The alpha level was set at 0.05. Statistical analyses were performed using IBM SPSS ver. 23 (Armonk, NY, USA).

Results

A total of 653 patients (541 and 112 with Phototype V and VI, respectively) from 16 different centres were finally recruited for the analysis, including 221 patients with papulosquamous dermatoses, 89 with facial hyperpigmented disorders, 63 with extra-facial hyperpigmented disorders, 79 with hypopigmented disorders, 49 with granulomatous dermatoses, 25 with sclerotic dermatoses, 59 with facial inflammatory diseases and 68 with uncommon/miscellaneous conditions. Diagnosis was made based on histology, typical clinical features and microbiological tests in 246, 362 and 45 cases, respectively. Relevant dermoscopic clues of the dermatoses belonging to the above-mentioned seven clinical categories are summarized in *tables 1 and 2*. Examples of dermoscopic clues are depicted in *figures 1-4*. Additionally, details on sample size, analytic results and comparison analysis of dermoscopic findings for the seven clinical categories as well as descriptive data on uncommon/miscellaneous conditions are provided as supplementary material (table S1-S9).

Discussion

Papulosquamous dermatoses

In line with a previous study on dermoscopy of psoriasis, pityriasis rosea and lichen planus in dark skin [15], vessels in papulosquamous dermatoses in our analysis were less frequently detected as compared to existing data for fair-skinned patients. In fact, psoriasis was the only condition with a significant prevalence of vascular structures, with uniform dotted vessels strictly related to this diagnosis, as seen in Caucasians [1, 2]. The common evidence of vessels in psoriasis in dark-skinned patients could be related to the significant epidermal acanthosis, typical of this disease, that makes the skin background lighter, thus enhancing the optical contrast of vessels [17].

Scaling was a frequent finding in most papulosquamous dermatoses, yet details on colour and distribution helped characterize some of them. In particular, white scales distributed in a uniform and central pattern were respectively associated with psoriasis and hypertrophic lichen planus, while white peripheral scaling was found to be typical of tinea corporis, pityriasis rosea and pityriasis lichenoides chronica. Importantly, morphology and direction of the free edge of the scales were different among these three conditions, which were shown to exhibit a jagged outer free edge, jagged inner free edge and smooth inner free edge, respectively. These differences are due to diverse peeling progression (tinea corporis and pityriasis rosea) [18] and the mechanism of collarette formation (pityriasis lichenoides chronica; resulting from detachment of a smooth mica-like central scale) [15]. Similar to studies on fair skin [1, 2], we found a correlation between patchy yellow scales/crusts and eczematous dermatitis, though we also showed an association with patchy brown scales/crusts. This feature results from hyperkeratosis and spongiosis/dried serum (for yellow scales/crusts) along with melanin exfoliation, which is more frequent in dark skin [10]. Of note, albeit less commonly, yellow and/or brown scales/crusts were also seen in tinea corporis (both yellow and brown) and pityriasis rosea (only brown), but always with a peripheral distribution.

Regarding follicular features, we found that both hypertrophic lichen planus and follicular eczema were characterized by follicular plugs, but only the latter disorder constantly showed a regular distribution and a white perifollicular halo due to perifollicular acanthosis [17]. Broken hairs were predominantly seen in prurigo nodularis and lichen amyloidosus as the result of repetitive and vigorous scratching, yet no statistical correlation was found as they were also detected in other diseases (*e.g*. psoriasis, eczematous dermatitis and tinea corporis).

Regarding findings other than vessels, scales and appendages features (*i.e*. "other structures"), we observed a significant association between peripheral-radiating white lines and prurigo nodularis (due to the presence of thickened dermal collagen fibres with a vertical arrangement on histology) [19] as well as purple dots and eczematous dermatitis (as the result of repetitive scratching) [17], although the latter feature was observed less commonly also in other conditions (*i.e.* psoriasis, lichen planus pityriasis lichenoides, and prurigo nodularis). White structureless areas (focal or diffuse) and pigmentary structures (brown/grey dots/globules or structureless areas), respectively resulting from acanthosis and basal layer pigmentation/dermal pigment incontinence [12], were often detected in several conditions, and were therefore not absolutely specific to any diagnosis. Notably, pigmentary structures in papulosquamous dermatoses are not frequent in fair-skinned patients and tend to be more related to inflammation-induced pigmentation, typical of darker phototypes [10].

Finally, several clues related to specific diagnoses were observed in our analysis, thereby confirming data from previous reports/studies [1-4, 20, 21]: (I) Wickham striae (resulting from hypergranulosis) in classic lichen planus; (II) adherent fabric fibres in eczematous dermatitis (related to their entrapment by dried serum); (III) white globules with sharp margins and lack of skin creases in lichen nitidus (representing a well-circumscribed lymphohistiocytic inflammatory cell infiltrate located under

Table 1. Relevant dermoscopic clues for papulosquamous dermatoses and facial and extra-facial hyperpigmented dermatoses with prevalence data.

Dermatosis *(n)*	**Dermoscopic clues* *(%)***
Papulosquamous dermatoses	
Psoriasis *(n = 34)*	Uniform dotted vessels *(67.6%)* Diffuse white scales *(76.5%)*
Eczematous dermatitis *(n = 24)***	Clustered dotted vessels *(25.0%)* Patchy yellow scales/crusts *(58.3%)* Patchy brown scales/crusts *(50.0%)* Patchy white scales *(62.4%)* White focal structureless areas *(37.5%)* Purple dots *(58.3%)* Fabric fibres *(50.0%)*
Lichen planus (classic) *(n = 32)*	Wickham striae *(93.8%)* Peripheral dotted vessels *(25.0%)* Grey dots *(25.0%)*
Lichen planus (hypertrophic) *(n = 15)*	Follicular plugs *(93.3%)* Central white scales *(46.6%)*
Tinea corporis *(n = 13)*	Peripheral white scales (jagged outer free edge) *(76.9%)* Peripheral brown scales/crusts *(38.5%)* Peripheral yellow scales/crusts *(15.4%)*
Pityriasis rosea *(n = 23)*	Peripheral white scales (jagged inner free edge) *(87.0%)*
Pityriasis lichenoides chronica *(n = 15)*	Peripheral white scales (smooth inner free edge) *(80.0%)* Central (mica-like) scale *(20.0%)*
Porokeratosis *(n = 10)*	Brown/white peripheral keratotic tract with a double free edge *(100.0%)*
Prurigo nodularis *(n = 20)*	Peripheral-radiating white lines *(85.0%)* Purple globules *(35.0%)* White globules *(30.0%)*
Lichen amyloidosis *(n = 11)*	Central brown/white dot/globule with peripheral pigmentation *(100.0%)* Brown dots *(72.7%)*
Follicular eczema *(n = 11)****	Follicular plugs (with white halo) *(100.0%)*
Lichen nitidus *(n = 13)*	White globules with sharp margins and lack of skin creases *(100.0%)*
Facial hyperpigmented dermatoses	
Lichen pigmentosus *(n = 16)*	Periostial brown dots *(75.0%)*
Ashy dermatosis *(n = 11)*	Periostial blue dots *(90.9%)* Periostial grey dots *(72.7%)*
Riehl melanosis *(n = 17)*	Intraostial brown dots *(58.8%)*
Melasma *(n = 19)*	Diffuse brown structureless areas with ostial sparing *(57.9%)*
Exogenous ochronosis *(n = 13)*	Interostial brown/grey semicircles *(53.8%)* Interostial brown/grey circles *(46.2%)* Interostial brown globules *(53.8%)* Interostial grey globules *(46.2%)* Focal brown structureless areas with ostial obliteration *(53.8%)* Focal white structureless areas *(53.8%)*
Nevus of Ota *(n = 13)*	Focal brown structureless areas with ostial sparing *(84.6%)* Focal grey structureless areas with ostial sparing *(53.8%)*
Extra-facial hyperpigmented dermatoses	
Lichen pigmentosus *(n = 14)*	Diffuse brown structureless areas *(92.9%)* Brown dots *(92.9%)*
Ashy dermatosis *(n = 13)*	Grey dots *(92.3%)* Blue dots *(76.9%)*
Macular amyloidosis *(n = 10)*	Central brown/white dot/globule with peripheral pigmentation *(100.0%)* Focal white structureless areas *(70.0%)*
Pityriasis versicolor *(n = 16)*	White scales in skin furrows *(87.5%)* Perifollicular white scales *(56.3%)*
Frictional melanosis *(n = 10)*	Perifollicular white colour *(80.0%)*

**Dermoscopic findings showing statistical significance when comparing dermatoses belonging to the same clinical category (Pearson's Chi-Square test corrected per Bonferroni for multiple comparisons, with alpha set to $p < 0.001$ to account for alpha inflation). **Including atopic dermatitis and allergic contact dermatitis, and excluding lichenified lesions as these can display different features due to a different histological background (psoriasiform hyperplasia). ***Variant of atopic dermatitis more common in dark-skinned patients with prevalent follicular involvement.*

Table 2. Relevant dermoscopic clues for hypopigmented dermatoses, granulomatous dermatoses, sclerotic dermatoses and facial inflammatory dermatoses with prevalence data.

Dermatosis *(n)*	**Dermoscopic clues* *(%)***
Hypopigmented dermatoses	
Vitiligo *(n = 18)*	Diffuse bright white areas with sharp margins *(88.9%)* White hairs *(44.4%)*
Idiopathic guttate hypomelanosis *(n = 12)*	Periostial (follicles/eccrine sweat glands) brown pigmentation *(91.7%)* Complete perieccrine brown pigmentation (circles) *(91.7%)* Peripheral white projections *(83.3%)*
Achromic pityriasis versicolor *(n = 11)*	White scales in skin furrows *(90.9%)* Perifollicular white scales *(63.6%)* Perifollicular white colour *(54.5%)*
Pityriasis alba *(n = 12)*	Diffuse dull white areas with blurred margins *(88.9%)* Incomplete perieccrine brown pigmentation (semi-circles) *(41.7%)*
Nevus depigmentosus *(n = 15)*	Intralesional brown reticular lines *(80.0%)*
Hypopigmented leprosy *(n = 11)*	Reduced appendages (follicles/sweat glands) (in absence of fibrosis/ulceration) *(81.8%)*
Granulomatous dermatoses	
Leishmaniasis *(n = 14)*	Follicular plugs *(78.6%)* White lines *(78.6%)* Ulceration *(64.2%)*
Leprosy *(n = 13)*	Focal dull white structureless areas *(92.3%)* Reduced appendages (follicles/sweat glands) (in absence of fibrosis/ulceration) *(84.6%)*
Lupus vulgaris *(n = 12)*	Focal bright white structureless areas *(92.3%)*
Sarcoidosis *(n = 10)*	Diffuse orange structureless areas *(40.0%)*
Sclerotic dermatoses	
Morphea *(n = 14)*	Focal dull white areas *(71.4%)*
Cutaneous lichen sclerosus *(n = 11)*	Focal/diffuse bright white areas *(100.0%)* Follicular plugs *(81.8%)*
Facial inflammatory dermatoses	
Rosacea *(n = 11)*	Reticular linear vessels *(63.6%)* Periostial (follicles/eccrine sweat glands) brown pigmentation *(72.7%)*
Seborrheic dermatitis *(n = 10)*	Patchy yellow scales/crusts *(60.0%)* Patchy brown scales/crusts *(40.0%)* Focal dull white structureless areas *(70.0%)*
Discoid lupus erythematosus *(n = 12)*	Follicular plugs *(100.0%)* Focal brown structureless areas with ostial obliteration *(58.3%)*
Granulomatous diseases *(n = 16)*	Orange structureless areas *(43.8%)*
Lichen actinicus *(n = 10)*	Focal/diffuse brown structureless areas with ostial sparing *(80.0%)* Wickham striae *(80.0%)*

**Dermoscopic findings showing statistical significance when comparing dermatoses belonging to the same clinical category (Pearson's Chi-Square test corrected per Bonferroni for multiple comparisons, with alpha set to $p < 0.001$ to account for alpha inflation).*

a flat epidermal-dermal junction); (IV) peripheral keratotic tract with double free edges in porokeratosis (corresponding to the cornoid lamella); and (V) central brown/white dot/globule with peripheral pigmentation in lichen amyloidosis (resulting from roundish amyloid deposit -with or without melanin- in the tip of dermal papillae and adjacent basal layer pigmentation or dermal-free melanin/melanophages).

Facial hyperpigmented dermatoses

Pigmentary findings were the most common features in this group. Despite an overlap among diseases, some findings were statistically related to specific diagnoses. In line with prior data [22, 23], we found that brown structureless areas with ostial sparing (brown pseudonetwork) were a constant and typical feature (only diffuse areas) of melasma, reflecting basal layer pigmentation on histology. As previously reported [22, 23], we also observed a grey pseudonetwork and interostial dots, possibly related to a dermal component of the disease, as well as periostial annular pigmentation (periostial brown circles), but these were not found to be specific.

Lichen pigmentosus and ashy dermatosis were typified by dots, with periostial brown dots significantly associated with the former and periostial blue dots with the latter. Additionally, periostial grey dots were more frequent in ashy dermatosis than lichen pigmentosus, although this difference was less relevant. The typical periostial arrangement of dots in these disorders has already been emphasized in previous studies on dark-skinned patients and reflects the periappendage distribution of melanin/melanophages [24, 25], whose different localization in the dermis (papillary in lichen pigmentosus and reticular in ashy dermatosis)

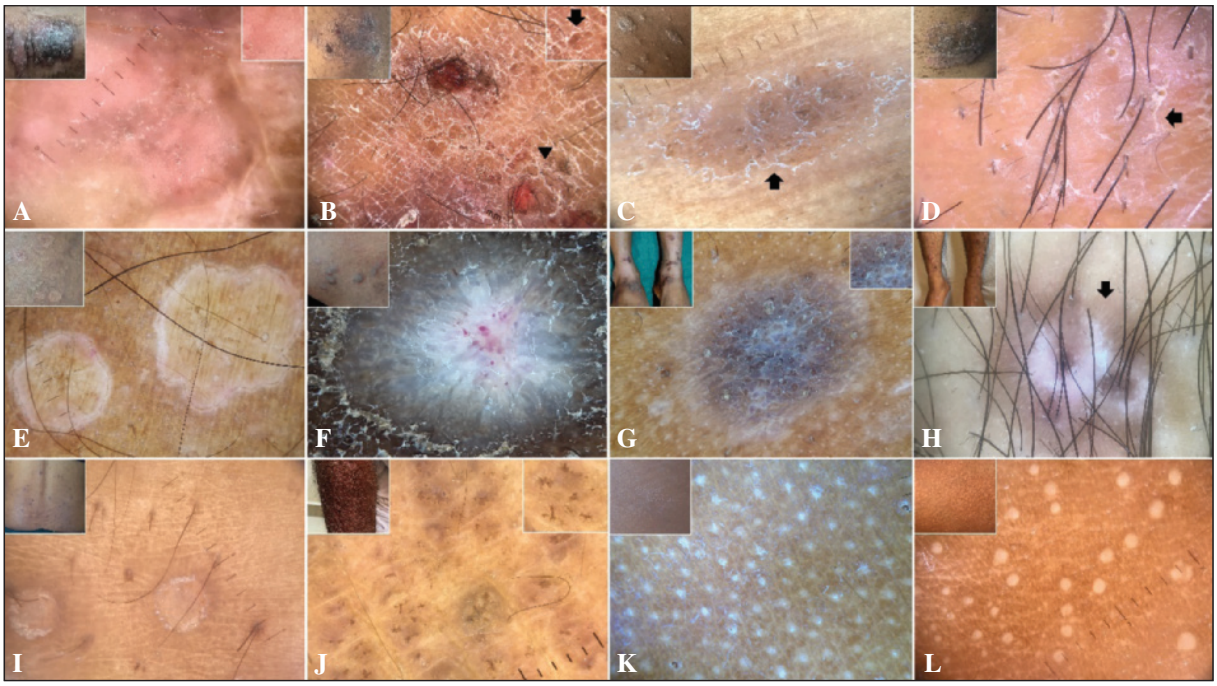

Figure 1. Dermoscopy of papulosquamous dermatoses. **A**) Psoriasis (Phototype VI): uniform dotted vessels (more clearly visible in the box) and diffuse white scales, but also structureless brown areas. **B**) Eczematous dermatitis (Phototype VI): patchy scales, both white and brown (more clearly visible in the box; arrow), along with haemorrhagic crusts and fabric fibres (arrowhead). **C**) Pityriasis rosea (Phototype VI): typical peripheral white scaling with a jagged inner free edge (arrow). **D**) Tinea corporis (Phototype VI): peripheral white scaling with a jagged outer free edge (arrow). **E**) Porokeratosis (Phototype V): typical peripheral brown keratotic tract with a double free edge. **F**) Classic lichen planus (Phototype V): white-bluish Wickham striae. **G**) Hypertrophic lichen planus (Phototype V): both Wickham striae and follicular plugs (the hallmark of this variant of lichen planus; more clearly visible in the box). **H**) Prurigo nodularis (Phototype V): typical peripheral white radiating striae (arrow) over a brown background. **I**) Pityriasis lichenoides chronica (Phototype VI): peripheral scaling with a smooth inner free edge. **J**) Lichen amyloidosus (Phototype VI) showing the typical hallmark of this condition, *i.e*. brown dots with peripheral brown radiating striae (more clearly visible in the box). **K**) Follicular eczema (Phototype VI): plugs with white halos. **L**) Lichen nitidus (Phototype V): typical well-defined white structures devoid of skin furrows.

is responsible for the different colour of dots on dermoscopy [26]. Pigmented dots have also been described in Riehl melanosis, but without a predilection for periappendage areas [24, 25]. This is consistent with our study, in which dots (mainly brown or grey) were most commonly arranged in an interostial or intraostial pattern. Notably, the presence of intraostial brown dots were specifically related to Riehl melanosis and could be the result of an appendage reaction with pigment dispersion due to the possible transappendage absorption of some haptens [27].

Focal white areas and interostial pigmentary structures (including brown/grey globules, circles and semi-circles), corresponding to showing focal loss of melanin and ocher pigment arranged in different patterns in the dermis, respectively, were found to be characteristic of exogenous ochronosis. These findings have already been reported in the literature under various "metaphoric" terms ("confetti-like" depigmentation, caviar-like structures, worm-like pattern, *etc*.) [28, 29]. Although, similar to previous studies, we also observed pigmented (brown and grey) areas with follicular openings obliteration [28, 29], such findings were not absolutely specific to exogenous ochronosis as they were also seen in nevus of Ota. Notably, this condition also commonly displayed both a brown and grey pseudonetwork, although a statistical association was found only for the latter.

Extra-facial hyperpigmented dermatoses

The dermoscopic pattern for lichen pigmentosus and ashy dermatosis on extra-facial areas is the same as that for the facial counterpart, except for the lack of a specific periostial pattern (due to a lower density of appendages in extra-facial areas) and the more common brown background visible in the former, consistent with previous data.

According to our analysis, pityriasis versicolor and frictional melanosis are often typified by poorly characterizing findings, namely a brown network or structureless areas related to basal layer hyperpigmentation, yet they may also show specific features, including white scaling (in the skin furrows or perifollicular areas) and perifollicular white areas, respectively. The presence of white scaling in the skin furrows has been reported as the most characterizing feature in pityriasis versicolor in both fair [9] and dark [30, 31] skin, while only studies on dark skin have also described perifollicular scales [30, 31]. These scaling patterns are the result of *Malassezia* tropism for more humid/oily areas [9]. In contrast to a previous study on dark-skinned patients [31], we did not observe a perilesional white halo, probably because we excluded cases also displaying achromic lesions. Regarding frictional melanosis, only data from Caucasians are available [9]. Although a similar pattern of pigmentation was described, no perifol-

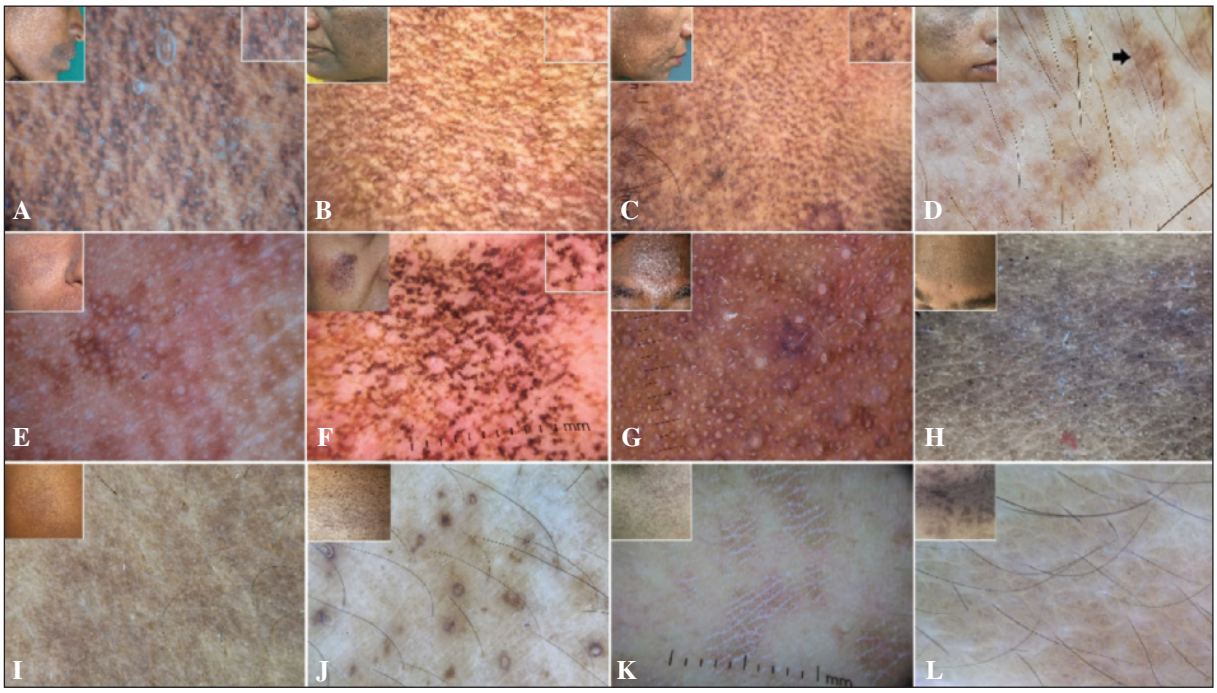

Figure 2. Dermoscopy of facial hyperpigmented dermatoses (**A**-**H**) and extra-facial hyperpigmented dermatoses (**I**-**L**). **A**) Ashy dermatosis (Phototype V): typical periostial blue dots/globules (more clearly visible in the box). **B**) Lichen pigmentosus (Phototype V): periostial brown dots (more clearly visible in the box). **C**) Riehl melanosis (Phototype V): brown dots displaying a prevalent interostial and intraostial distribution pattern (more clearly visible in the box). **D**) Nevus of Ota (Phototype V): focal brown and grey structureless areas; follicular/eccrine gland ostia are generally spared but in some areas are lacking (arrow). **E**) Melasma (Phototype V): brown structureless areas with typical ostial sparing. **F**) Exogenous ochronosis (phototype V): interostial brown circles and semi-circles (more clearly visible in the box) are the dermoscopic hallmark of this condition. **G**) Frictional melanosis (Phototype VI): a diffuse brown hyperpigmentation along with periostial brown circles. **H**) Acanthosis nigricans (Phototype VI): brown polygonal areas giving rise to a "cobblestone" pattern. **I**) Frictional melanosis (Phototype VI): brown reticular lines (magnified in the box). **J**) Macular amyloidosis (Phototype V): white globules with peripheral brown/grey pigmentation (circles or radiating lines; more clearly visible in the box). **K**) Pityriasis versicolor (Phototype V): brown structureless areas along with white scales in the skin furrows. **L**) Gougerot-Carteaud syndrome (Phototype V): brown polygonal areas giving rise to a "cobblestone" pattern.

licular white areas (corresponding to scratching-induced perifollicular acanthosis) were reported, likely because they tend to be more related to follicular reactions in dark skin [10].

Finally, consistent with previous studies on lighter phototypes [21], in our analysis, macular amyloidosis showed a specific dermoscopic pattern, which is the same as that for lichen amyloidosis, due to an histological overlap.

Hypopigmented dermatoses

Consistent with previous studies on skin of colour [32, 33], vitiligo was significantly associated with well-defined glowing/bright white areas in our analysis, yet such a finding was commonly seen also in idiopathic guttate hypomelanosis, therefore making it difficult to discriminate between these two entities. Similarly, pityriasis alba constantly displayed ill-defined dull white areas, which were also frequently observed in hypopigmented leprosy; both are typically characterized by only a partial decrease in melanin content. On the other hand, nevus depigmentosus and pityriasis versicolor showed variable findings in terms of shade and sharpness of depigmentation.

In line with available literature data [32-35], periostial brown pigmentation (circles/semicircles around follicles/eccrine sweat glands) was present in several hypopigmented disorders in our study, yet peri-eccrine brown circles and semi-circles were found to be statically associated with idiopathic guttate hypomelanosis and pityriasis alba, respectively. This might be related to a higher resistance of peri-eccrine melanocytes to sun-induced damage in the former and to partial resistance to exfoliation of melanin located around eccrine sweat glands in the latter. Interestingly, idiopathic guttate hypomelanosis also revealed a strict correlation with peripheral white projections, which have already been reported in dark skin under metaphoric terms (*e.g.* ameboid, petaloid and feathery pattern) [35]. Interestingly, unlike fair skin [36], none of our patients with idiopathic guttate hypomelanosis displayed a perilesional brown network, likely because darker phototypes are less prone to develop sun-induced hyperpigmentation.

Lastly, in agreement with previous studies on dark phototypes [30-35, 37], white scales in the skin furrows or in a perifollicular distribution were characteristic of achromic pityriasis versicolor, while white hairs, an intralesional brown network and reduced appendages (follicles/eccrine sweat glands) were more indicative of vitiligo, nevus depigmentosus and hypopigmented leprosy, respectively.

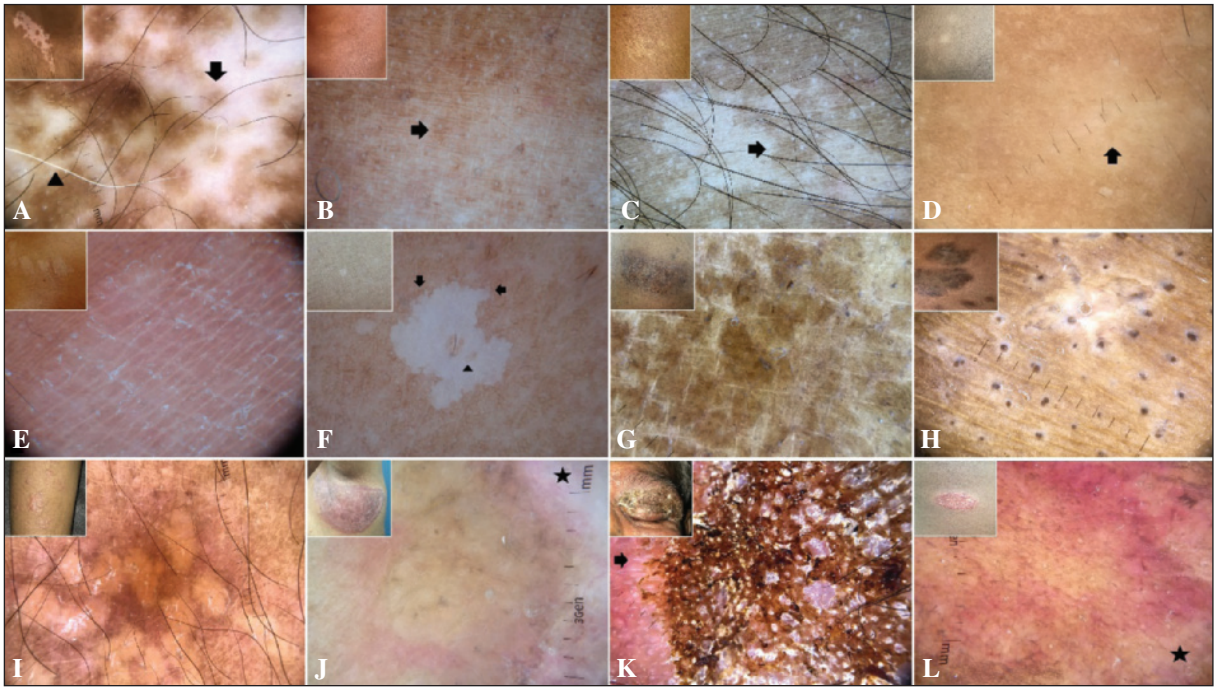

Figure 3. Hypopigmented dermatoses (**A**-**F**), sclerotic dermatoses (**G**-**H**) and granulomatous dermatoses (**I**-**L**). **A)** Vitiligo (Phototype VI): bright white areas along with perifollicular pigmentation (arrow) and white hairs (arrowhead). **B**) Hypopigmented leprosy (Phototype VI): an ill-defined dull white background along with reduced appendages (follicles/eccrine glands) and residual brown reticular pigmentation (arrow). **C**) Nevus depigmentosus (Phototype V): a well-defined bright white background with intralesional brown reticular lines (arrow). **D**) Pityriasis alba (phototype VI): an ill-defined dull white background along with faint periostial brown circles/semicircles (arrow). **E**) Achromic pityriasis versicolor (Phototype V): an ill-defined dull white background as well as white scales in the skin furrows and perifollicular areas. **F**) Idiopathic guttate hypomelanosis (Phototype V): a well-defined bright white background with peripheral projections (arrows) and intralesional periostial brown circles (arrowhead). **G**) Morphea (Phototype V): dull white focal structureless areas and white lines. **H**) Cutaneous lichen sclerosus (Phototype VI): bright white structureless areas along with brown follicular plugs. **I**) Sarcoidosis (Phototype V): orange-yellow structureless areas. **J**) Lupus vulgaris (Phototype V): orange-yellow structureless areas and bright white areas (star). **K**) Leishmaniasis (Phototype V): diffuse follicular plugs (arrowhead) and peripheral white striae (arrow). **L**) Plaque-type leprosy (Phototype VI): orange-yellow structureless areas along with residual reticular brown lines, reduced appendages (follicles/eccrine glands) and dull white focal structureless areas (star).

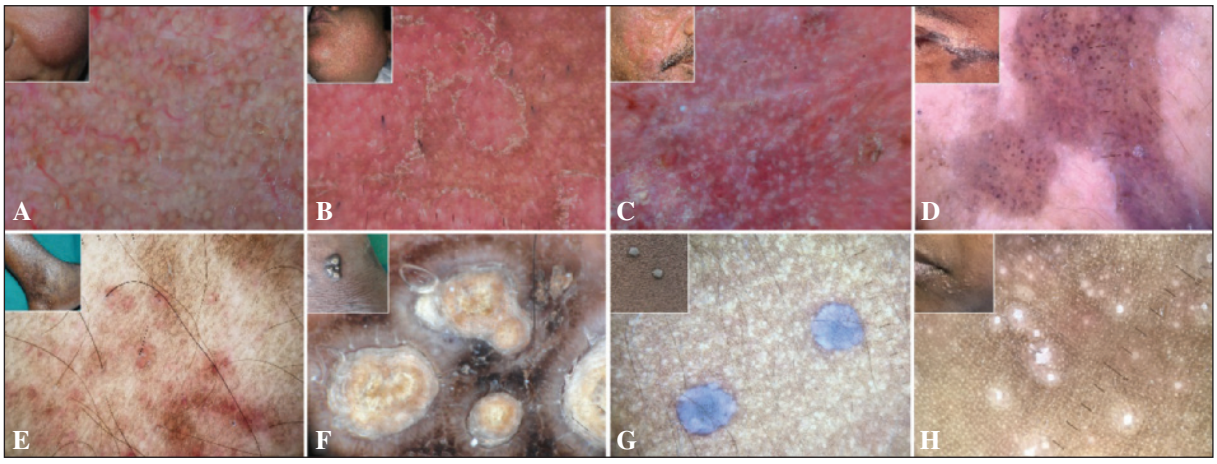

Figure 4. Facial inflammatory dermatoses (**A**-**D**) and miscellaneous (**E**-**H**). **A**) Erythematotelangiectatic rosacea (Phototype V): typical linear vessels with a reticular arrangement as well as periostial brown circles/semicircles. **B**) Seborrheic dermatitis (Phototype V): patchy white and yellow/brown scales. **C**) Discoid lupus erythematosus (Phototype V): diffuse follicular plugs along with non-specific white scaling. **D**) Lichen actinicus (Phototype V): brown structureless areas with ostial sparing and Wickham striae (visible as a peripheral whitish annular structure); in this case brown follicular plugs are also seen. **E**) Capillaritis (Phototype V): reticular brown lines and purple areas. **F**) Acquired perforating dermatosis (Phototype V): the typical three-zonal concentric pattern (keratotic centre with a collarette scaling and a white halo) along with a peripheral brown halo. **G**) Common wart (Phototype VI): brown dots over a bluish background. **H**) Molluscum contagiosum (Phototype VI): typical bright white globules/dots.

Granulomatous dermatoses

Orange structureless areas corresponding to dermal granulomas ("mass effect") have been reported as the dermoscopic hallmark of granulomatous disorders in several studies [5, 38]. However, our results suggest that such areas are less common and often feature an orange-yellow hue in dark skin, likely because of the brown background.
In line with previous evidence, we found follicular plugs to be significantly associated with the diagnosis of leishmaniasis, although they were also seen in leprosy and lupus vulgaris [12, 38, 39]. Additionally, both ulceration and white lines (irrespective of distribution pattern) were associated with leishmaniasis, although a specific association with peripheral white lines was not identified, unlike previous studies [12, 38, 39]. On the other hand, focal dull white areas (due to a loss of melanin content) and decreased appendages (follicles/eccrine sweat glands) (in the absence of fibrosis/ulceration) were statistically related to leprosy, confirming data from previous descriptive studies on the topic [40, 41].
Finally, sarcoidosis and lupus vulgaris were found to be characterized by diffuse orange areas and focal bright areas, respectively. Notably, such a difference has never been described in fair skin [38], likely because lighter phototypes are less prone to sclerotic reaction than in dark skin.

Sclerotic diseases

Our findings are consistent with a previous comparative analysis of Caucasians [42], showing that follicular plugs and focal bright white areas are indicative of lichen sclerosus and focal dull white areas associated with morphea. These differences reflect a diverse histological background, in which lichen sclerosus exhibits follicular hyperkeratosis (resulting in dermoscopic follicular plugs) along with superficial fibrosis (responsible for a brighter shade of white areas on dermoscopy) and morphea displays deeper fibrosis (related to a duller shade of white areas on dermoscopy) [42].

Facial inflammatory dermatoses

In the group of facial inflammatory dermatoses, we observed several similarities with lighter phototypes [43]. Specifically, linear vessels with a reticular arrangement were associated with rosacea, follicular plugs with discoid lupus erythematosus, yellow scales with seborrheic dermatitis and orange structureless areas with granulomatous diseases. Notably, unlike fair skin, we commonly observed pigmentary findings in several diseases (especially brown areas with ostial obliteration in discoid lupus erythematosus and perifollicular brown circles in rosacea) as well as focal white areas and brown scales in seborrheic dermatitis. The presence of white areas is explained by the common occurrence of post-inflammatory depigmentation in seborrheic dermatitis affecting dark-skinned patients, while brown scales are due to hyperkeratosis and pigment exfoliation (more typical of skin of colour) [10].
Regarding lichen planus actinicus, little data is available in the literature. Our analysis suggests that the most important dermatoscopic findings of the disease are brown structureless areas with ostial sparing, possibly reflecting widespread pigment incontinence, and Wickham striae (visible as a peripheral whitish annular structure) corresponding to the underlying hypergranulosis.

Uncommon conditions and miscellaneous

This category included pityriasis rubra pilaris, keratosis pilaris, acquired perforating dermatoses, facial frictional melanosis and acanthosis nigricans, Gougerot-Carteaud syndrome, progressive macular hypomelanosis, granuloma annulare, necrobiosis lipoidica, demodicosis, warts (flat, common and genital), molluscum contagiosum and capillaritis. Their patterns did not differ significantly from those reported for fair skin [1, 9, 44, 45], apart from the presence of pigmentary structures, including a brown network in capillaritis, brown halo in acquired perforating dermatoses, brown dots in flat warts, and a bluish background in common and genital warts. Of note, facial frictional melanosis and acanthosis nigricans are nearly exclusive of dark skin. In our analysis, they displayed an accentuated brown pseudonetwork and/or periostial brown pigmentation and a "cobblestone" or "sulci and gyri" pattern, respectively.

Conclusions

In conclusion, our findings suggest that dermoscopy might be a useful tool in assisting the diagnosis of clinically similar non-tumoral dermatoses for dark phototypes by revealing characteristic clues. The main limitation of this study is the retrospective design that is prone to recall and observation biases, which were addressed by involving evaluators who did not contribute to sample collection. Moreover, all the suggested dermoscopic-histological correlations were based on previous studies/common reasoning. In addition, sample size for less common diseases was small and some considered diseases may show histological overlap making them difficult to distinguish (*e.g.* lichen pigmentosus and ashy dermatosis). Therefore, our results should be interpreted with caution and future research including dermoscopic-histological analyses are needed to validate our findings. ■

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Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1684/ejd.2020.3928.

Table S1. Dermoscopic features of papulosquamous dermatoses with prevalence data and comparative analysis.

Table S2. Dermoscopic features of facial hyperpigmented dermatoses with prevalence data and comparative analysis.

Table S3. Dermoscopic features of extra-facial hyperpigmented dermatoses with prevalence data and comparative analysis.

Table S4. Dermoscopic features of hypopigmented dermatoses with prevalence data and comparative analysis.

Table S5. Dermoscopic features of granulomatous dermatoses with prevalence data and comparative analysis.

Table S6. Dermoscopic features of sclerotic dermatoses with prevalence data and comparative analysis.

Table S7. Dermoscopic features of facial dermatoses with prevalence data and comparative analysis.

Table S8. Dermoscopic findings of less common skin diseases.

Table S9. Dermoscopic findings of miscellaneous dermatoses (disorders not falling into any of the defined clinical categories).

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