Dermatology Practical & Conceptual

Dermoscopy of Hair and Scalp Disorders (Trichoscopy) in Skin of Color – A Systematic Review by the International Dermoscopy Society "Imaging in Skin of Color" Task Force

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ABSTRACT Hair and scalp disorders are of significant interest for physicians dealing with dark phototypes due to their prevalence and potential aesthetic impact resulting from a higher tendency for scarring. In order to facilitate their non-invasive diagnosis, several dermoscopic studies have been published, yet data are sparse and no systematic analysis of the literature has been performed so far. This systematic literature review summarizes published data on trichoscopy of hair and scalp diseases (trichoscopic findings, used setting, pathological correlation, and level of evidence of studies). A total of 60 papers addressing 19 different disorders (eight non-cicatricial alopecias, nine cicatricial alopecias, and two hair shaft disorders) were assessed, for a total of 2636 instances. They included one cross-sectional analysis, 20 case-control studies, 25 case-series, and 14 single case-reports, so the level of evidence was V and IV in 65% and 33% of cases, respectively, with only one study showing a level of evidence of III. Notably, although there is a considerable body of literature on trichoscopy of hair/scalp diseases, our review underlined that potentially significant variables (e.g., disease stage or hair texture) are often not taken into account in published analyses, with possible biases on trichoscopic patterns, especially when it comes to hair shaft changes. Further analyses considering all such issues are therefore needed.

Introduction

Hair and scalp disorders represent a relevant part of dermatologist's practice when it comes to dark-skinned patients due to their significant prevalence as well as potential aesthetic impact resulting from a higher tendency for scarring in case of cicatricial alopecias [1]. Additionally, there are several alopecic diseases that are exclusively or predominantly seen in darker phototypes (Fitzpatrick's phototypes IV-VI), especially subjects of African descent [1,2]. In order to facilitate the recognition of hair and scalp disorders, some studies focusing on their dermoscopic pattern have been performed, yet data are sparse and no systematic analysis of the literature evidence has been published so far 2.

This review, performed by *the International Dermoscopy Society* (IDS) Task Force on "Imaging in Skin of Color", sought to systematically analyze trichoscopic findings of hair and scalp diseases reported in dark-skinned patients.

Materials and Methods

This systematic review was performed in accordance with the *PRISMA* (Preferred Reporting Items for Systematic Reviews and MetaAnalyses) guidelines. A search of the articles published up to 30th June 2022 was performed through the *PubMed* electronic database using the following search terms: "trichoscopy" OR "dermoscopy" OR "epiluminescence" OR "dermatoscopy" AND "skin of color" OR "dark skin" OR "black skin" OR "ethnic skin" OR "dark phototype" OR "african skin" OR "indian skin". Titles and abstracts were screened by two independent reviewers to identify papers reporting trichoscopic findings of hair and scalp disorders; non-English articles, reviews, personal opinions and editorials as well as duplicates were excluded. A manual search was also performed by assessing the reference sections of all significant studies or reviews on this topic.

Articles considered not relevant and those not providing trichoscopic structures according to specific dermatosis/number of patients with particular tichoscopic structures were excluded after full-text reading. Only articles specifically dealing with Fitzpatrick's phototypes IV-VI were included. In case information on the skin phototype was not provided, decision on inclusion was made based on a title/abstract/full text showing that the manuscript concerned "dark skin" or "skin of color" and for single cases also based on the attached figures. We also included papers from African, Indian subcontinent, and Caribbean countries as most of patients from these areas feature IV-VI skin phototype. Importantly, studies grouping light and dark phototypes without dedicated subanalyses were excluded, apart from those with only a minority of light-skinned patients being involved (i.e., less than 20% of total).

All of the retrieved studies were classified based on standard definitions for diagnostic accuracy studies [3,4] and their level of evidence was assigned according to *The Oxford 2011 Levels of Evidence* [5]. Trichoscopic findings,

histopathological background (if available), trichoscopic setting (polarized *vs* non-polarized/magnification degree), skin type of the patient (if specified), and number of cases were assessed and summarized.

Results

The initial PubMed search showed 1287 publications, with a total of 71 items admitted to the full-text reading after title and abstract screening and excluding duplicates. Of these, eleven papers were ruled out according to the exclusion criteria, with 60 articles being eventually admitted to the review analysis. The flow chart displaying the study selection process is showed in Figure 1.

The full-text review included a total of 60 studies, including one cross-sectional analysis, 20 case-control studies, 25 case-series, and 14 single case-reports; the number of records according to the level of evidence presented were as follows: I: 0; II: 0; III: 1; IV: 20; and V: 39. In detail, 19 different disorders (also accounting for relevant disease variants with clinical/trichoscopic peculiarities) were evaluated, including eight non-cicatricial alopecias, nine cicatricial alopecias, and two hair shaft disorders for a total of 2636 cases. Table 1 shows the number of studies and total number of included instances for each condition.

Trichoscopic setting (polarized *vs* non-polazised) was reported in 24/60 records (14 polarized; 5 non-polarized; 5 both), magnification in 46/60 records (24: x10; 7: x20; 1: x30; 1: x58; 1: x60; 12: variable magnification), and trichoscopic-pathological correlation in 18/60 records (even though some correlated not all trichoscopic findings). Supplemental Table summarizes all such data, along with analytical description of each of the study evaluated in the review (number of patients, type of study and level of evidence), trichoscopic features, skin type of the patient. Table 1 also displays the general prevalence of trichoscopic findings for each condition, calculated considering all the data available from the literature. For practical purpose, we have grouped analyzed disorders into non-cicatricial alopecias, cicatricial alopecias, and hair shaft disorders. Figures 2 and 3 show dermoscopic clues of such conditions.

Non-Cicatricial Alopecias

Alopecia Areata

Alopecia areata (AA) is one of the most studied non-cicatricial alopecias from a trichoscopic point of view in skin of color, with 24 studies (11 case-control analyses [6-16], 11 case-series [7-27], and two single case-reports [28,29]) retrieved from the literature with a total of 1206 patients. The most commonly observed finding were yellow dots, found in 67% of cases, followed by black dots and short vellus hairs, detected in 62% and 48% of cases, respectively. Other frequent features included broken hairs (36%) and "micro-exclamation mark" hairs (31%). Pigtail and straight regrowing hairs, coudability hairs (hairs tapered at the proximal end), off-white dots (empty follicles), erythema, honeycomb pigmentation, white dots, i-hairs, tulip hairs, Pohl-Pinkus constrictions, perifollicular scales, and perifollicular discoloration were all observed in less than 10% of cases.

With regard to diagnostic accuracy, yellow dots have been identified as a sensitive marker for AA diagnosis, though their sensitivity increased from 89.6% to 97.4% when associated with short vellus hairs according to a study

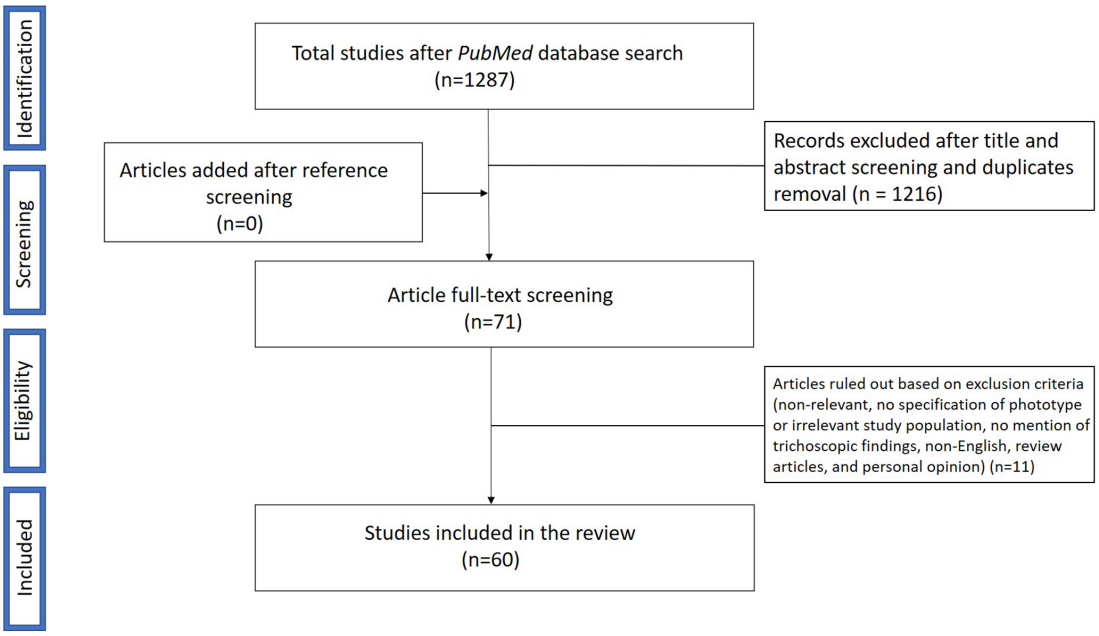

Figure 1. PRISMA flowchart displaying the selection process for study inclusion in the systematic review.

Table 1. Total number of studies, instances and prevalence of trichoscopic findings of hair and scalp disorders in skin of color.

Disorder	Total number of studies	Total number of instances	Trichoscopic findings* (total prevalence)
Non-cicatricial alopecias			
Alopecia areata	24	1206	*Common findings:* Yellow dots (67%); Black dots (62%) *Less common findings:* Short vellus hair (48%); Broken hair (36%); Exclamation mark hair (31%); Pigtail hair (9%); Straight regrowing hair (9%); Coudability hair (8%); Off white dots (6%); White dots (5%); Honeycomb pigment pattern (3%); Erythema (3%); Vascular pattern (3%); Atypical red vessels (1%); Perifollicular scales (1%); Tulip hair (1%); Leukotrichia (1%); Perifollicular pigmentation (1%)
Androgenetic alopecia			
Female pattern hair loss	9	544	*Common findings:* Hair diameter diversity >20% (87%); Short vellus hair (66%) *Less common findings:* Brown peripilar sign (35%); Single-hair follicular unit (29%); Thin hair (22%); Yellow dots (18%); Lower mean hair thickness in frontal area (9%); >10% thin hairs in frontal area (9%); Honeycomb pigment pattern (6%); White dots (5%); Focal atrichia (5%); White peripilar sign (4%); >2:1 single hair units, frontal: occiput (4%); >3:1 hair follicles with perifollicular discoloration, frontal: occiput (4%); >4 yellow dots in frontal area (3%); >1.5:1 vellus hair, frontal: occiput (3%); Scales (1%); Off white dots (1%); Broken hair (1%)
Male pattern hair loss	3	102	*Common findings:* Hair diameter diversity >20% (85%); Yellow dots (84%); Honeycomb pigment pattern (78%); Brown peripilar sign (67%) *Less common findings:* White peripilar sign (39%); Short vellus hair (22%); Thin hair (19%); Focal atrichia (13%); White dots (8%)
Pressure-induced alopecia	1	6	*Common findings:* Yellow dots (100%); Short vellus hair (100%); Black dots (83%); Comedo-like black dots (67%); Broken hair (50%); Areas of scarring (50%) *Less common findings:* -
Telogen effluvium	3	53	*Common findings:* Straight regrowing hair (81%) *Less common findings:* Single-hair follicular unit (38%); Off white dots (28%); Yellow dots (17%); Thin hair (13%); Perifollicular erythema (2%)

Disorder	Total number of studies	Total number of instances	Trichoscopic findings* (total prevalence)
Tinea capitis	14	261	*Common findings:* Black dots (57%); Comma hair (55%) *Less common findings:* Broken hair (47%); Corkscrew hair (31%); Perifollicular scales (22%); Zigzag hair (20%); Erythema, telengectasia heamorrhage (13%); Morse code hair (11%); i-hair (8%); Pustules (4%); White dots (3%); Perifollicular pigmentation (3%); Off white dots (empty follicle) (2%); Flame hair (1%); Honeycomb pigment pattern (1%); Thin hair (1%); White areas (1%); Loss of follicles (1%)
Traction alopecia	3	9	*Common findings:* - *Less common findings:* Peripilar casts (44%); Single-hair follicular unit (40%); Loss of follicles (33%); Black dots (11%); Follicular pustules (11%); Short vellus hair (11%)
Trichotillomania	14	46	*Common findings:* Broken hair at different length (93%); Trichoptilosis (67%); Black dots (63%); Hook hair (52%) *Less common findings:* Peripilar haemorrhages (48%); V-sign (30%); Flame hair (26%); Tulip hair (17%); Straight regrowing hair (17%); Yellow dots (11%); Perifollicular scales (11%); Variation-HDD (9%); White dots (9%); Short vellus hair (7%); Hair dust (7%); Honeycomb pigment pattern (7%); Pigtail hair (4%); Single-hair follicular unit (4%); Blotchy-pigmentation (2%); Perifollicular whitish halo (2%)
Cicatricial alopecias			
Central centrifugal cicatricial alopecia	2	65	*Common findings:* Honeycomb pigment pattern (100%); Perifollicular whitish halo (95%); Pinpoint white dots (81%); Terminal hair (78%); Cicatricial white patches (74%); Short vellus hair (74%) *Less common findings:* Erythema (48%); Broken hair (40%); Scales (36%); Asterisk like brown areas (19%); Dark peripilar halo (7%)
Discoid lupus erythematosus	9	159	*Common findings:* Follicular plugging (68%); Cicatricial white patches (50%) *Less common findings:* Scales (47%); Perifollicular whitish halo (43%); Telangiectasias (39%); Red dots (35%); Brown dots (30%); Rosettes (19%); Thick arborizing vessels (17%); Perifollicular scales (17%); Blue-grey dots (14%); Honeycomb pigment pattern (11%); Perifollicular erythema (9%); Scalp erythema (8%); Enlarged branching vessels (5%); Red loop vessels (5%); White dots (eccrine openings) (3%); Black dots (2%); Crust formation (1%); Short vellus hair (1%); Blue-white veil (1%); Peripilar casts (1%); Fibrotic white dot (1%)

Table 1 Continues

Disorder	Total number of studies	Total number of instances	Trichoscopic findings* (total prevalence)
Dissecting cellulitis of the scalp			
Scarring stage	2	9	*Common findings:* Loss of follicles (100%); Cicatricial white patches (78%); Black dots (78%); Crust formation (67%); Perifollicular scales (67%); Yellow dots (67%); Elongated linear vessels (67%); Interfollicular scaling (67%); Scalp erythema (67%) *Less common findings:* 3D yellow dots (44%); Hair shaft disorder (pili torti and Pohl-Pinkus constrictions) (44%); Epidermal atrophy (33%); Follicular pustules (33%); Honeycomb pigment pattern (33%); Follicular hyperkeratosis (22%); Red loop vessels (22%); Blue-grey dots (22%); Perifollicular erythema (11%); Peripilar casts (11%); Fibrotic white dot (11%); Perifollicular pigmentation (11%)
Early (non-scarring) stage	1	5	*Common findings:* Yellow dots (100%); Red dots (100%); Empty follicular openings (100%); Black dots (100%); Cadaverized hairs (100%) *Less common findings:* -
Fibrosing alopecia in a patterned distribution	1	16	*Common findings:* Loss of follicles (100%); Hair diameter diversity (100%); Perifollicular erythema and scaling (88%); Hyperpigmented perifollicular halo (75%); Scattered white patches (75%); Honeycomb pigment pattern (75%); Perifollicular whitish halo (56%) *Less common findings:* Follicular plugging (19%)
Folliculitis decalvans	5	12	*Common findings:* Loss of follicles (83%); Perifollicular scales (67%); Follicular pustules (58%); Hair tufting (50%) *Less common findings:* Cicatricial white patches (42%); Perifollicular erythema (42%); Scalp erythema (42%); Scales (33%); Crust formation (33%); Black dots (25%); Perifollicular whitish halo (25%); White dots (eccrine openings) (25%); Honeycomb pigment pattern (25%); Epidermal atrophy (17%); Elongated linear vessels (17%); Yellow dots (17%); Arborizing vessels (17%); Follicular plugging (17%); Red loop vessels (8%); Fibrotic white dot (8%); Speckled pigmentation (8%); Blue-grey dots (8%); Hair shaft disorder (pili torti and Pohl Pinkus constrictions) (8%)
Frontal fibrosing alopecia	4	14	*Common findings:* Loss of follicles (93%); Perifollicular erythema (57%); Perifollicular scales (57%); Cicatricial white patches (50%); Honeycomb pigment pattern (50%); *Less common findings:* Telangiectasias (36%); Scalp erythema (29%); Blue-grey dots (29%); Predominance of one hair follicles (14%); Epidermal atrophy (14%); Follicular hyperkeratosis (14%); Peripilar casts (14%); Interfollicular scaling (14%); Hair shaft disorder (pili torti and Pohl Pinkus constrictions) (14%); Black dots (14%); White dots (14%); Off white dots (empty follicles) (7%); Scattered brown discoloration (7%); Perifollicular pigmentation (7%); Short vellus hair (7%); Yellow dots (7%)

Disorder	Total number of studies	Total number of instances	Trichoscopic findings* (total prevalence)
Lichen planopilaris	8	107	*Common findings:* Loss of follicles (98%); Perifollicular scales (78%); Cicatricial white patches (69%); Honeycomb pigment pattern (60%); Scalp erythema (57%) *Less common findings:* Blue-grey dots in targetoid pattern (42%); Perifollicular erythema (37%); Scales (34%); Blue-grey dots (21%); White dots (eccrine openings) (19%); Blue-grey dots in speckled pattern (16%); Hair shaft disorder (pili torti and Pohl Pinkus constrictions) (14%); Red loop vessels (13%); Enlarged branching vessels (12%); Peripilar casts (12%); Fibrotic white dot (10%); Black dots (10%); Follicular plugging (9%); Hair tufting (5%); Elongated linear vessels (4%); Red dots (2%); Off white dots (empty follicles) (1%)
Pseudopelade of Brocq	6	13	*Common findings:* Loss of follicles (100%) *Less common findings:* White dots (eccrine openings) (46%); Cicatricial white patches (46%); Perifollicular scales (39%); Yellow dots (23%); Blotchy pigmentation (23%); Epidermal atrophy (16%); Perifollicular erythema (16%); Thin hair (16%); Honeycomb pigment pattern (7%); Scales (7%); Broken hair (7%); Black dots (7%)
Hair shaft disorders			
Monilethrix	6	8	*Common findings:* Beaded hair with equidistant nodes and internodes (100%) *Less common findings:* Broken hair (25%); Angulated hair (25%); Yellow dots (13%) Perifollicular Scales (13%)
Woolly hair syndrome	1	1	*Common findings:* Short wave circles of hair shaft - “crawling snake appearance” (100%) *Less common findings:* -

*Trichoscopic findings are divided into common (prevalence ≥ 50%) and less common (prevalence < 50%).

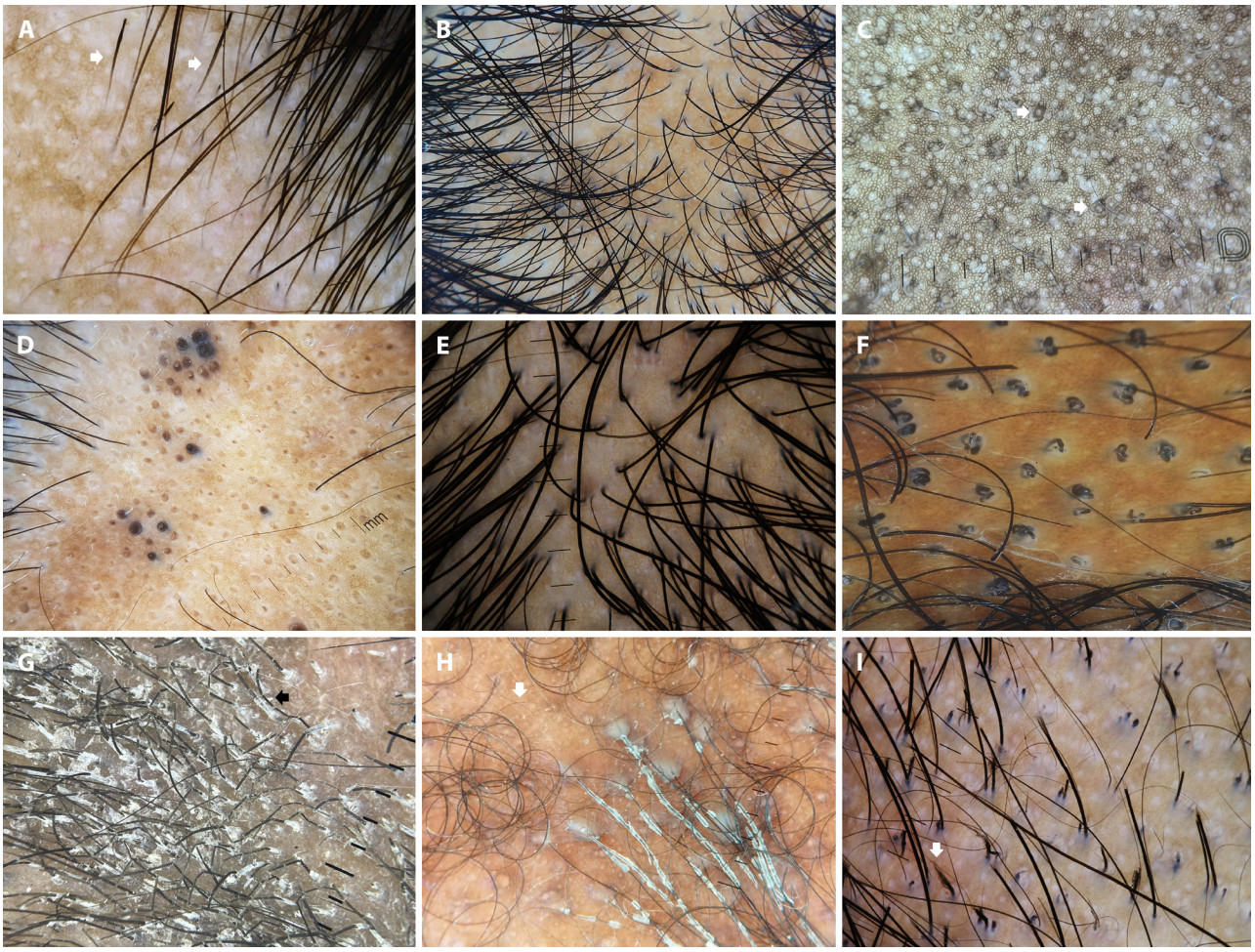

Figure 2. Examples of trichoscopic clues of non-cicatricial alopecias in dark-skinned patients: Exclamation mark hairs (arrows) in alopecia areata (A); Hair diameter diversity along with thin hairs in early androgenetic alopecia (B); Multiple vellus hairs and brown pigmentation round follicular ostia (brown peripilar sign – arrows) in advanced androgenetic alopecia (C); Comedo-like black dots and yellow dots in pressure-induced alopecia (D); Several follicular units with single hair shaft and lack of other specific trichoscopic criteria in telogen effluvium (E); Comma-like hairs as well as corkscrew-like hairs in tinea capitis (F); Diffuse and perifollicular white scaling along with "Morse code" hairs (arrow) in tinea capitis (G); White peripilar casts, single-hair follicular units, loss of follicles and thin/vellus hair (arrow) in traction alopecia (H); Broken hairs at different length, trichoptilosis, black dots and flame hairs (arrow) in trichotillomania (I).

by Bapu *et al*. [6] Similarly, diagnostic value of exclamation mark hairs in AA was higher when detected along with yellow dots, black dots, short vellus hairs and/or short regrowing hairs based on the study by Amer *et al* [15]. Additionally, the same authors found that the presence of pigtail hairs was related to spontaneous remission [15].

Moving to disease activity, yellow dots and short vellus hairs were related to stability, while black dots, broken hairs, coudability hairs, tapering hairs, and exclamation mark hairs were are all positively correlated with disease activity, with coudability hairs being reported to be more specific than broken hairs [22]. However, exclamation mark hairs have also been observed in long-standing non-progressive AA in a study by Govindarajulu *et al* [14].

Of note, based on the studies by Bapu *et al* [6] and Jha *et al* [19], a higher density of yellow dots would be related to the disease severity, with the highest mean number of yellow dots per field of view being seen in alopecia universalis (50.3 ± 53.6) and the lowest density (22.2±13.1) being detected in localized patchy AA. Conversely, the study by Kibar *et al* found no relationship between the number of yellow dots and AA subtype and activity, while the authors observed honeycomb-pattern pigmentation, cumulus-like clustered white dots, white dots and black dotted pigmentation to be positively correlated with disease severity [9]

Finally, Ganjoo *et al* evaluated trichoscopic changes following intralesional steroid therapy and found that the presence of exclamation mark hairs was the first feature to disappear after four weeks of treatment, followed by broken hairs/black dots and yellow dots (12 and 16 weeks, respectively). At four weeks of treatment, the appearance of pigtail hairs and pigmented hairs was also noted [20]. Other studies showed that treated or remitting lesions of AA showed an increased number of short vellus hairs and terminal hairs [14,18,19].

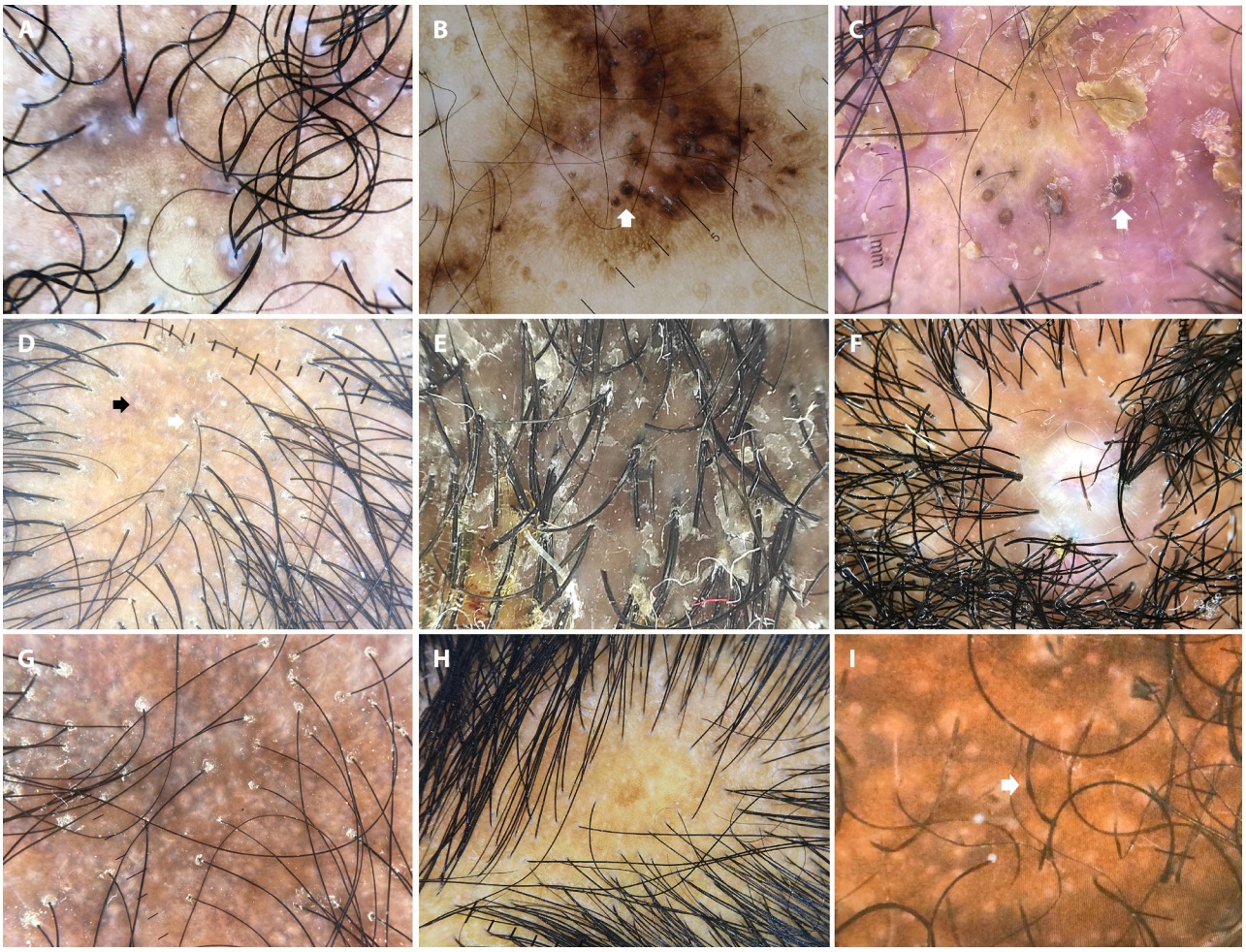

Figure 3. Examples of trichoscopic clues of cicatricial alopecias in dark-skinned patients: Honeycomb pigment pattern, pinpoint white dots and the characteristic perifollicular thick whitish halo in central centrifugal cicatricial alopecia (A); Brown follicular plugs (arrow), cicatricial white patches and diffuse brown honeycomb pigmentation in discoid lupus erythematosus (B); loss of follicles, cicatricial white patches, a black dot, yellow crusting and the characteristic "3D yellow-brown dots" (arrow) in dissecting cellulitis (scarring stage) (C); Loss of follicles, perifollicular white scaling, hyperpigmented perifollicular halo (white arrow), and perifollicular whitish halo (back arrow) in fibrosing alopecia in a patterned distribution (D); Yellow crusting and white scaling in folliculitis decalvans (early stage) (E); Loss of follicles, cicatricial white patches and hair tufting in folliculitis decalvans (advanced stage) (F); Perifollicular scales, multiple fibrotic white dots and small patches, blue-grey dots in targetoid pattern (around fibrotic white dots) in lichen planopilaris (G); Loss of follicles but evidence of white dots (eccrine openings) along with honeycomb pigment pattern in pseudopelade of Brocq (H); Beaded hair with equidistant nodes and internodes (arrow) in monilethrix (I).

Androgenetic Alopecia

A total of nine studies (eight case-control analyses [10-12,14,30-33] and one case-series [34]) assessing trichoscopic features of female pattern hair loss (FPHL) comprising a total of 544 cases were identified. The most prevalent finding was hair diameter diversity (HDD), seen in 87 % of cases (also including two studies which considered HDD of more than 10% of hair instead of the most used cutoff of 20% [14,34]). Further notable findings included short vellus hairs (66%), brown peripilar sign (35%), single-hair follicular units (29%), thin hairs (20%), and yellow dots (18%), while several other features were found in less than 10% of cases, such as honeycomb pigment pattern, white dots, white peripilar sign, and focal atrichia [10-12,14,30-34].

Bhrama *et al* focused on the diagnostic value of HDD >20% in FPHL, with a sensitivity of 75% for Grade 1 FPHL and 93% for FPHL in general, thereby underling that it is a consistent feature in pattern hair loss and can be used as a diagnostic tool [33].

Notably, Nikam *et al* found that the brown peripilar sign, which represents perifollicular inflammation, was seen more frequently in cases of androgenetic alopecia compared to tinea capitis and trichotillomania [11]. Finally, Tawfik *et al* observed that yellow dots and white dots were positively correlated with advanced stages of hair loss and that all patients displayed HDD with an increased percentage of miniaturized vellus hairs in the frontal and temporal areas [31].

Moving to male pattern hair loss (MPHL), a total of three trichoscopic studies (two case-control [12,14] and one

case-series [34]) were retrieved for a total of 102 instances. The most common finding was still HDD greater than 20%, observed in 85% of cases, whereas additional common features included yellow dots (84%), honeycomb pigment pattern (78%), brown peripilar sign (67%), white peripilar sign (39%), and short vellus hairs (22%). Thin hairs, focal atrichia and white dots were seen in less than 20% of cases.

Pressure-Induced Alopecia

A single retrospective case-control study by Neema *et al* on trichoscopy of pressure-induced alopecia (PIA) was found in the literature [13]. The most common features included yellow dots and short vellus hairs, while black dots, comedo-like black dots, broken hairs and areas of scarring were additional findings. When compared with alopecia areata, comedo-like black dots, black dots, and scarring areas were significantly more prevalent in PIA, while exclamation mark hairs were significant for alopecia areata.

Telogen Effluvium

Three case-control studies describing trichoscopy of telogen effluvium (TE) were retrieved with a total of 53 cases [10,12,14]. In general, the most common reported trichoscopic feature was upright regrowing hairs seen in 81% of cases, followed by single hair follicular units (38% of cases) and off-white dots (empty follicles) (28% of cases) [10,12,14]. Additional less commonly described findings included thin hairs and perifollicular erythema. However, prevalence variability among studies did exist [10,12,14]. Notably, unlike other studies, Chiramel *et al* found a low prevalence of upright regrowing hairs, while thin hairs were found to be the most common feature [12]. Moreover, the same authors also observed honeycomb pigment pattern, pigtail hairs and yellow dots in chronic TE [12].

Tinea Capitis

A total of 261 cases of tinea capitis (TC) have been investigated from a trichoscopic point of view in nine studies (one cross-sectional [35] and eight case-control [8,10-12,14-16,36]) along with two case-series [37,38] and three single case-reports [39-41]. The most prevalent finding was the presence of black dots (57% of cases). Other common features (observed in more than 20% of cases) included comma hairs, broken hairs, perifollicular white scales, and corkscrew hairs. Less frequent findings were zigzag hairs, erythema, telangiectasias, hemorrhages, morse code hairs, i-hairs, pustules, and white dots (eccrine openings). Of note, the association of perifollicular scaling with any dystrophic hairs or broken hairs was found to be a specific trichoscopic pattern of TC in a controlled study by Brasileiro *et al* [36], whereas Chiramel *et al* showed that the presence of comma hairs was in favor of TC diagnosis when compared to alopecia areata [12].

Importantly, trichoscopic variability according to the clinical/microbiological subtype was also observed. In detail, corkscrew hairs, comma hairs and zigzag hairs turned out to be more suggestive of the endothrix variant, while perifollicular scales were more specific of "grey patch" TC and black dots, erythema, telangiectasias and haemorrhages of kerion [35]. Finally, comma hairs, black dots, and perifollicular scaling were reported to be more frequent in "black dot" TC [35].

With regard to post-treatment monitoring, the disappearance of dystrophic hairs was reported as a marker of therapeutic success in a prospective study by Campos *et al* involving 50 patients [42]. In the same study, the authors also found persistence of perifollicular scaling despite negative results of mycological culture.

Traction Alopecia

A total of nine instances of traction alopecia (TA) with trichoscopic description have been reported in the literature (two case-control studies [8,10] and a single case series [43]), with peripilar casts and single hair follicular units being the most common features (44% and 40% of cases, respectively). Peripilar casts have also been reported to be present in case of diffuse TC at the margins of the patches. Additional less common findings included loss of hair follicles, black dots, follicular pustules, and short vellus hairs.

Trichotillomania

We found five case-control studies [8,10-12,14] as well as three case-series [44-46] and three single case-reports [47-49] on trichotillomania encompassing 46 cases. Broken hairs of variable length were the most common trichoscopic feature, being observed in 93% of cases. Further common findings included trichoptilosis, black dots and hook hairs (more than half of all cases) as well as peripilar hemorrhages, V-sign and flame hairs (more than one-fourth of all cases). On the other hand, less frequent features were tulip hairs, straight regrowing hairs, yellow dots, perifollicular scales, hair diameter diversity, white dots (eccrine openings), short vellus hairs, hair dust, and honeycomb pigment pattern. Of note, broken hairs of variable length and trichoptilosis were found to be indicative of trichotillomania when compared to alopecia areata in a study by Chiramel *et al* [12]. Finally, according to a study conducted by Saqib *et al*, the presence of straight and pigtail hairs indicate hair regrowth in patients with trichotillomania [10].

Cicatricial Alopecias

Central Centrifugal Cicatricial Alopecia

A retrospective case-control study [50] and a case series [51] involving a total of 65 instances of central centrifugal cicatricial alopecia (CCCA) were retrieved. In general, honeycomb

pigmentation pattern, perifollicular white halo, pinpoint white dots and cicatricial white patches were the main findings (100%, 95%, 81% and 74% of cases, respectively), being commonly found in both studies. When compared to other scarring alopecias, perifollicular white halo turned out to be the most accurate finding, with 100% of specificity and 94% of sensitivity. Notably, this trichoscopic feature was present in both early and late stages of CCCA. Additional trichoscopic findings included terminal hairs, short vellus hairs, erythema, scaling (mainly perifollicular), asterisk-like brown areas, broken hairs, black dots, and dark peripilar halos.

Discoid Lupus Erythematosus

Discoid lupus erythematosus (DLE) was one of the most studied form of scarring alopecias from a trichoscopic point of view, with seven case-control studies, [10-12,52-54] two case-series, [55,56] and a single case-report [57] involving a total of 159 instances. Follicular plugs, white scarring patches and perifollicular white halos were the most common findings, with a prevalence of 50%, 47% and 43%, respectively. Other main features included telangiectasias, red dots and brown dots (39%, 35% and 30% of cases). Many additional less frequent findings have been reported (Table 1 and Supplemental Table). Considering diagnostic accuracy, tortuous branching vessels (seen as irregular coiled vessels) were found to be specific (100% specificity) of DLE when compared to other forms of scarring alopecias based on the study by Abedini *et al* [52]. In line with such a finding, Chiramel *et al* showed that the detection of branching vessels was in favor of DLE compared to lichen planopilaris [12].

Of note, follicular plugs, thick arborizing vessels, perifollicular erythema, and follicular red dots have been found to be indicators of disease activity [55]. On the other hand, white areas and thin arborizing vessels have been reported more commonly in inactive DLE [11, 55]. Finally, red dots were found to be a positive prognostic factor of hair regrowth in a study by Thakur *et al* [53].

Dissecting Cellulitis of the Scalp

Fourteen instances of dissecting cellulitis of the scalp (DCS) reporting trichoscopic findings have been retrieved (two case-control studies including eight scarring cases [52,53] and a case-series involving five early cases [58]).

Considering scarring cases, besides the lack of follicular openings, being seen in all instances, other frequent findings (more than two-thirds of cases) included cicatricial white patches, black dots, crusts, perifollicular scales, yellow dots, elongated linear vessels, interfollicular scaling, and erythema. Less frequent findings are listed in Table 1/Supplemental Table. Notably, according to the study by Abedini *et al*, black dots were observed with a higher prevalence compared to other cicatricial alopecias [52]. Regarding "3D yellow dots", although considered to be a characteristic sign of DCS, they were observed in 44% of cases in total [52, 53].

Moving to early DCS, Tosti *el al*, described yellow dots, red dots, empty follicular openings, black dots, and cadaverized hairs, also emphasizing that the lack of exclamation mark hairs may be a clue to differentiate early DCS from alopecia areata [58].

Fibrosing Alopecia in a Patterned Distribution

A single trichoscopic study involving a total of 16 patients with fibrosing alopecia in a patterned distribution (FAPD) is available from the literature [59]. Loss of follicle openings and hair diameter diversity were detected in all cases. Additionally, perifollicular scaling and erythema were present in 88% of cases, while hyperpigmented perifollicular halos, scattered white patches, and a honeycomb network were observed in 75% of cases. Lastly, white perifollicular halos and follicular plugs were observed in 56% and 19% of cases, respectively. Importantly, the study underlined that FAPD and CCCA may share several trichoscopic findings, with possible difficulties in their differentiation.

Folliculitis Decalvans

Twelve instances of folliculitis decalvans (FD) have been investigated on trichoscopy by five case-control studies [8,10,12,52,53]. In general, loss of follicular openings, perifollicular scaling, follicular pustules and hair tufting were the most common features, being detected in more than 50% of cases. Moreover, several additional findings were reported (Table 1/Supplemental table).

According to the study by Abedini *et al*, follicular pustules may also be observed in dissecting cellulitis of the scalp, yet the prevalence was higher in FD [52]. Another hallmark of FD was hair tufting, defined as tufts of ≥ 6 hair shafts emerging from one follicular opening [8,10,12,52,53]. Of note, pustules were found to be a marker of active FD, whereas hair tufting turned out to be an indicator of disease severity [53].

Frontal Fibrosing Alopecia

A total of 14 cases of frontal fibrosing alopecia (FFA) have been investigated from a trichoscopic point of view in three case-control studies [52-54] and one single case-report [60]. Besides the lack of follicular openings, showing a prevalence of 93%, the main trichoscopic findings included perifollicular erythema and scaling, both being detected in 57% of cases. Several other additional features were reported and are showed in Table 1/Supplemental table.

Lichen Planopilaris

Seven case-control studies [8,10-12,52-54] and a single case-report [57] on trichoscopy of lichen planopilaris (LPP)

were retrieved, for a total of 107 instances. Similarly to other cicatricial alopecias, loss of follicular openings was the most prevalent finding (98% of cases). Additionally, perifollicular scales, white areas and honeycomb pigment network were generally the main features (prevalence of 78%, 69% and 60%, respectively), followed by erythema (57% of cases) and blue-grey dots in a targetoid pattern (42% of cases). Less common findings are showed in Table 1/Supplemental table.

Of note, even though blue-grey dots are a common feature in both LPP and discoid lupus erythematosus, targetoid pattern arrangement were indicative of the former according to the study by Chiramel *et al* [12]. Similarly, Ankad *et al* found blue-grey dots in a target distribution along with perifollicular scaling to be characteristic of LPP [57]. Importantly, Abedini *et al* found perifollicular scaling and follicular plugs in both LPP and discoid lupus erythematosus, yet a more tubular appearance of perifollicular scaling and white color/smaller size of the plugs would be in favor of LPP [52].

Pseudopelade of Brocq

A total of 13 cases of pseudopelade of Brocq with trichoscopic description were available from the literature (five case-control studies [8, 10-12, 53] and one single case-report [61]). Loss of follicular ostia was a constant finding, while other common features included white dots (eccrine openings) and cicatricial white patches (both observed in 46% of cases) as well as and perifollicular scales (39% of cases). Less common findings are reported in Table 1/Supplemental table.

Hair Shaft Disorders

Monilethrix

Based on the findings coming from two case-control studies [8,12], one case-series [62], and three single case-reports [63-65] (for a total of eight patients), beaded hair with equidistant nodes and internodes, broken hairs, and a tendency for the hair to bend and break at the internodes (referred to as the "regularly bended ribbon sign") are the main hair shaft abnormalities seen on trichoscopy in monilethrix.

Woolly Hair Syndrome

We found a single case report on trichoscopy of woolly hair syndrome that reported hair shafts featuring short wave circles with a "crawling snake" appearance [66].

Conclusions

Trichoscopy of hair/scalp diseases have been extensively studied in skin of color, showing a relevant usefulness in highlighting diagnostic clues imperceptible to the unaided eye. Yet, there is still limited evidence on some conditions despite they are commonly encountered in clinical practice. Additionally, apart from few analyses, most of the published studies did not take into account disease stage, that may significantly affect trichoscopic pattern. Finally, there is little data on possible trichoscopic differences according to the hair texture as a significant variability does exist in the spectrum of dark-skinned populations, with patients of African descent being typically characterized by tight curly hair, that may potentially influence the trichoscopic patterns, especially when it comes to hair shaft changes. Further analyses considering all such gaps are therefore needed.

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