









REVIEW ARTICLE OPEN ACCESS

# Update on Pediatric Dermoscopy in Lighter Phototypes: Changes During the Evolution of the Diseases and Clues Predicting Response to Treatments

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## ABSTRACT

Dermoscopy is a noninvasive tool that enables the visualization of skin lesions with magnification, allowing for more accurate diagnosis. Over the years, it has evolved from a utility in differentiation between malignant and benign neoplasms to administration in the vascular, inflammatory, and infectious dermatoses. Dermoscopy is a very important diagnostic tool, especially in pediatric patients, due to its noninvasive and painless character. It not only enables the correct diagnosis but also may provide some prognostic clues, and after the treatment, it allows the dermatologist to observe the progress of therapy. The review aims at the discussion of the use of dermoscopy in the management of pediatric non-neoplastic dermatoses, namely, differential diagnosis, prognosis assessment, adjusting the treatment, and therapy outcome monitoring.

## 1 | Introduction

Dermoscopy is a noninvasive tool that enables the visualization of skin lesions with magnification, allowing for more accurate diagnosis. Over the years, it has evolved from a utility in differentiation between malignant and benign neoplasms to administration in the vascular, inflammatory, and infectious dermatoses [1]. Dermoscopy is a very important diagnostic tool, especially in pediatric patients, due to its noninvasive and painless nature. Not only does it enable the correct diagnosis, but it may also provide some prognostic clues, and after the treatment, it allows the dermatologist to observe the progress of therapy.

The review aims to discuss the use of dermoscopy in the management of pediatric non-neoplastic dermatoses, including

differential diagnosis, prognosis assessment, treatment adjustment, and monitoring of therapy outcomes.

## 2 | Vascular Lesions

### 2.1 | Infantile Hemangiomas

Infantile hemangioma (IH) is a benign vascular neoplasm that is characterized by rapid growth after birth, followed by stabilization and involution. Dermoscopy enables distinguishing IH from other vascular lesions, as it reveals well-demarcated, oval structures composed of red lacunae or lakes of blood, separated by white septae [2]. This examination also allows for dividing IH depending on their depth (superficial, deep, or mixed), since the lacunae vary in color: in superficial hemangiomas, they are

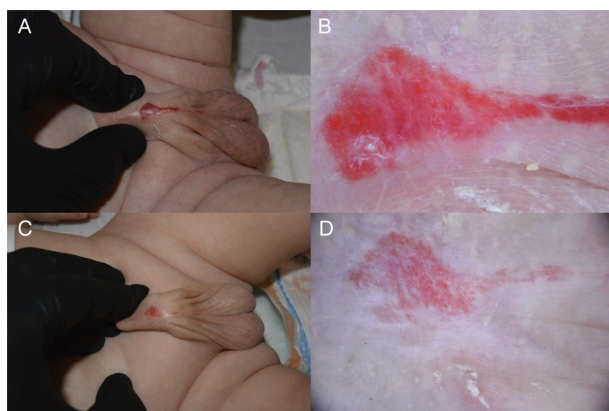
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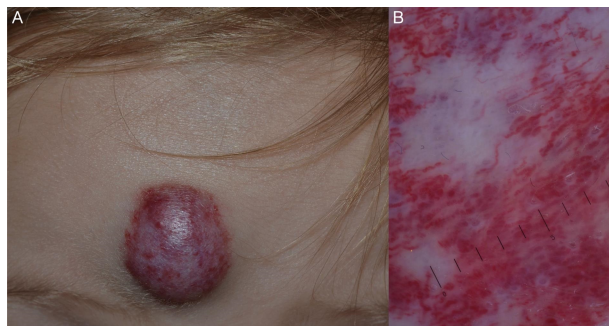
bright red; in deep lesions, they are blue or violet; moreover, the presence of enlarged curved (namely wavy) vessels was reported to be associated with deeper IHs [3] (Figures 1 and 2). Dermoscopy also aids in monitoring the lesion and in establishing appropriate treatment [4]. There are reports on how the lesion changes during the use of  $\beta$ -blockers, namely, erythema is reduced, and a milky-red area appears (Figure 1). Linear and clustered vessels are probably correlated with a more prominent response to therapy [5]. Dermoscopy also allows for earlier visualization of the impending ulceration (as the white color appears) and adjusting the therapeutic actions [4].

## 2.2 | Vascular Malformations

Vascular malformations are congenital vascular lesions occurring due to abnormal vascular development, which occur with a frequency of approximately 1.2%–1.5% [6]. They are divided into capillary, venous, lymphatic, and arteriovenous,



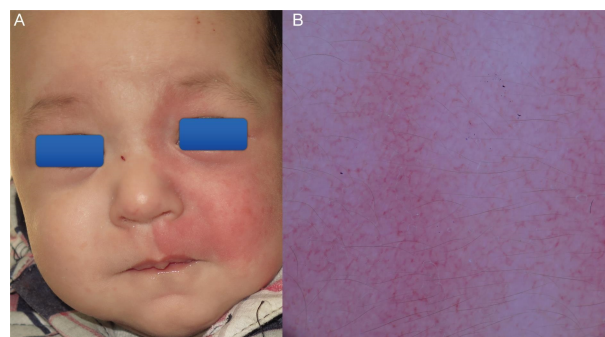
**FIGURE 1** | A mostly superficial scrotal infantile hemangioma of a 2-month-old baby. (A) Clinical picture before the treatment; (B) large red lacunae visible on dermoscopy; (C) clinical improvement of the same lesion after 3 months of treatment with topical timolol; (D) after the treatment, dermoscopy shows extensive whitish areas as a sign of regression and disappearance of lacunae and some residual vessels, indicating that the minor deep component of the hemangioma was still present.



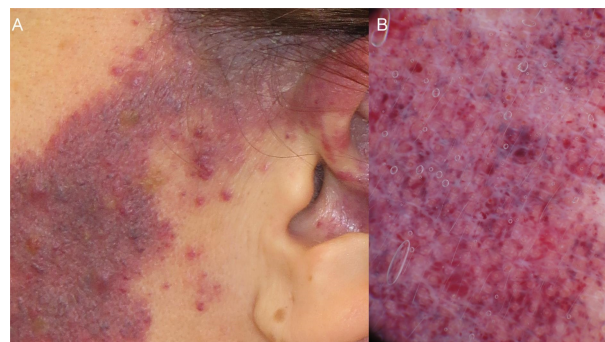
**FIGURE 2** | A partially regressive mixed infantile hemangioma of the forehead in an 18-month-old girl. (A) Clinical picture of a red-white nodule; (B) dermoscopic picture showing large whitish areas, confirming the involutational stage of the hemangioma. Moreover, while lacunae tend to regress fast over time, wavy vessels, typically associated with the deep component, are still visible.

and their prevalence decreases respectively [7]. Capillary malformations are the most frequent subtype (Figure 3). The port-wine stain malformations are characterized by the presence of dots and globules and a broken network of thick and/or thin vessels [8] (Figure 4). Angiokeratomas present red, purple, or even brownish lacunae with blue-whitish veil [2, 6]. Angioma serpiginosum manifests with multiple small oval red lacunae [2] (Figure 5). Venous malformations are the second most frequent, and on dermoscopy, they exhibit violet or blue, poorly defined, structureless areas with arborizing linear, irregular vessels [8]. Lymphatic malformations are characterized by the presence of yellow to light brown lacunae separated by pale septa with a “hypopyon-like” image [2]. Arteriovenous malformations exhibit reticular pigmentation with reticular vessels [9].

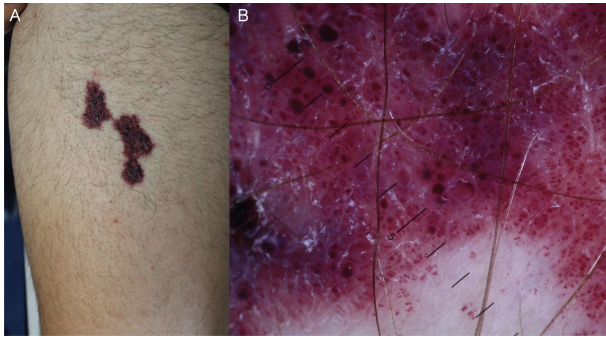
Dermoscopy is a useful tool in classifying various vascular lesions in children, along with the prediction of the response to treatment. Based on the dermoscopic assessment of the lesion depth, conclusions can be drawn about the outcomes of laser therapy. Reports have shown that malformations with superficially located vessels are associated with a good response to therapy with pulsed dye laser [4]. Similarly, in case of angioma serpiginosum, a dermoscopic appearance with multiple purplish dots has been associated with a higher response to laser [10] (Figure 5). On the other hand, white linear structures within a pink, white, or blue background, as well as pale halos surrounding central comedo-like structures, are associated with a worse response to therapy [4].



**FIGURE 3** | A capillary malformation of the face. (A) Clinical picture of a pinkish-reddish macule; (B) dermoscopic image reveals dotted vessels and linear perifollicular vessels.



**FIGURE 4** | A deeper port-wine stain of the face in an adolescent. (A) Clinical image of a purple-reddish plaque and papules; (B) wide tortuous violaceous vessels seen on dermoscopy.



**FIGURE 5** | Angioma serpiginosum on the lower limb of a young 16-year-old boy. (A) Clinical presentation of dark red plaques; (B) red to purple dots and lacunae seen at dermoscopy. This dermoscopic appearance seems to be predictive of a better response to the laser.

### 3 | Inflammatory Diseases

#### 3.1 | Psoriasis

Psoriasis, one of the most common diseases in daily dermatological practice, is characterized upon dermoscopy by evenly distributed dotted vessels on a pink background, covered with white-silverish scales (Figure 6). Based on the clinical presentation and dermoscopy, the majority of cases can be easily diagnosed without the need for invasive skin biopsy [4]. Obviously, along with the treatment duration, the reduction of vessels, including their diameter and tortuosity, should be observed, and their presence even after the topical therapy with the first-line agent, namely, combination of calcipotriol and betamethasone, is indicative of a quick relapse [11]. On the other hand, there are reports of hemorrhagic dot occurrence as a positive predictive sign in response to biological therapy (usually after 2–4 weeks) [11]. It has been noticed in psoriasis-induced hypopigmented macules that residual dotted vessels may be observed, thus supporting the previous diagnosis of psoriasis, even when not known [12]. When erythematous-scaly lesions are found solely on the scalp, dermoscopy allows differentiation between psoriasis and seborrheic dermatitis, which is characterized by the presence of arborizing thin blood vessels on a pink background and yellowish, greasy scaling [13]. UV-enhanced dermoscopy may aid the differential diagnosis between inverse psoriasis, erythrasma, and candidiasis in the intertriginous areas. The first



**FIGURE 6** | Classic plaque-type psoriasis in a young male. (A) Psoriatic plaques in clinical manifestation; (B) on dermoscopy, regularly distributed dotted vessels and silvery-white scales.

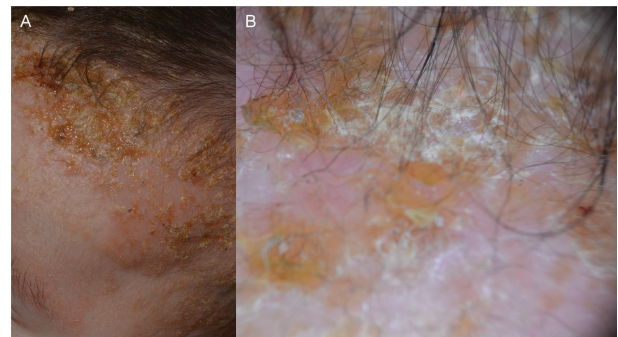
two diseases present red fluorescence, whereas candidiasis exhibits no fluorescence; moreover, the peripapillary distribution of the red fluorescence points more likely to psoriasis [14].

#### 3.2 | Atopic Dermatitis

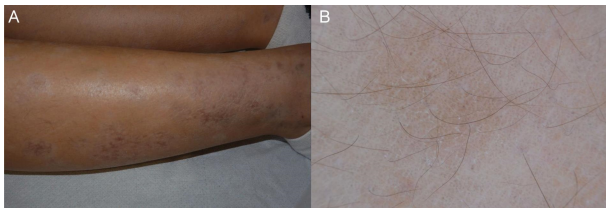
Atopic dermatitis (AD) is one of the most frequent dermatoses of childhood. It affects about 13% of children and usually begins in infancy [15]. The diagnosis of AD is usually made based on the clinical picture and according to the Hanifin and Rajka criteria [15]. Nevertheless, there are dermoscopic features of AD described, and based on dermoscopy, it is possible to distinguish between active and chronic (lichenification) stages of AD: active stages are characterized predominantly by yellow crusts and randomly distributed dotted vessels on the pink background, whereas in chronic phases, more uniformly distributed vessels are surrounded by a white halo [16]. Hemorrhagic dots may also be found due to intensive scratching [16]. It has been shown that dermoscopic signs change or resolve after the application of emollients and topical steroids [17], as well as after the treatment with dupilumab; vessels are distributed homogeneously and have a smaller caliber, and the erythema and scaling are less prominent [18]. Dermoscopy could also be a useful tool in the early detection of topical steroid side effects [11], such as atrophy and telangiectasia (see Figure 7).

#### 3.3 | Lichen Planus

Children are reported to comprise 2%–3% of all patients diagnosed with lichen planus (LP) [19]. The hallmark of LP is the Wickham striae, indirectly visible clinically and better visualized by dermoscopy as shiny silverish-whitish crossed lines (however, sometimes they may vary in color or arrangement) on a pinkish-reddish background. Apart from the striae, dotted, globular, or linear vessels at the border of the lesion may be observed, along with white or yellow dots and pigmented structures [11]. The dermoscopic features of LP change depending on the stage of the disease, which allows the dermatologist to observe advances in therapy and response to treatment. In the early stages, papules often present less prominent Wickham striae on an erythematous background. As the lesions mature, these striae become more pronounced, and peripheral blood vessels may also be seen. Over time, both the striae and vessels tend to diminish. In chronic or long-standing lesions, pigmentation may be the only observed sign [11] (Figure 8).



**FIGURE 7** | Atopic dermatitis (and other forms of eczema): (A) clinical picture of yellow crusts on erythematous background; (B) yellow crusting as a result of spongiosis is the main dermoscopic clue.



**FIGURE 8** | Lichen planus in the resolution phase. (A) Clinical picture of whitish and pale red macules; (B) even if not visible to the naked eye, gray dots are visible upon dermoscopy.

### 3.4 | Pityriasis Lichenoides

Pityriasis lichenoides et varioliformis acuta (PLEVA) occurs more frequently in children and young adults compared to older individuals; however, its exact prevalence is not certain [20]. There are only a few papers describing dermoscopic patterns of this entity. Dermoscopy may aid differential diagnosis and distinguish early lesions from resolving ones (Figure 9) [21]. At early stages, a structureless brownish area with white scales and dotted vessels at the periphery are found (Figure 9A,B). Later stages manifest with the central crust on a white structureless area surrounded by white scaling and hemorrhagic dots [21, 22].

Pityriasis lichenoides chronica (PLC) is characterized by the presence of focally distributed dotted or arborizing vessels and milky-red globules on an orange-yellow structureless background [21].

In the most recent paper comparing PLEVA and PLC, targetoid lesions were mentioned as more suggestive of PLEVA, whereas superficial scaling on a light brown background is more characteristic of PLC [23].

### 3.5 | Lichen Sclerosus

Lichen sclerosus (LS) may occur at any age, but two peaks are observed: first in prepubertal age and the other in the postmenopausal period [24]. LS may be present in the anogenital or extragenital area and exhibits distinct dermoscopic features,

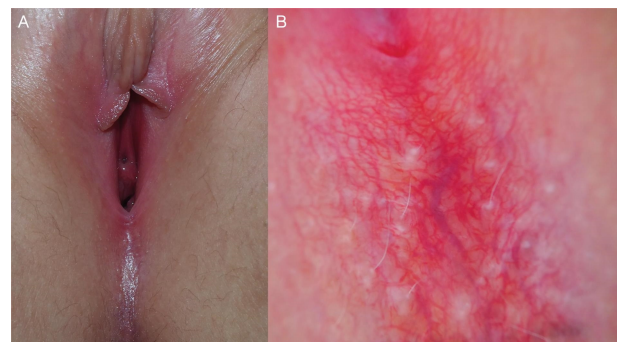


**FIGURE 9** | Active phase of pityriasis lichenoides et varioliformis acuta: (A) clinical presentation of polymorphous eruption, including macules, papules, vesicles, and erosions; (B) dermoscopy reveals central crusting, purpuric dots, and focal dotted vessels. Regressive phase of pityriasis lichenoides et varioliformis acuta: (C) clinically visible hypopigmented macules; (D) on dermoscopy, fine gray dots.

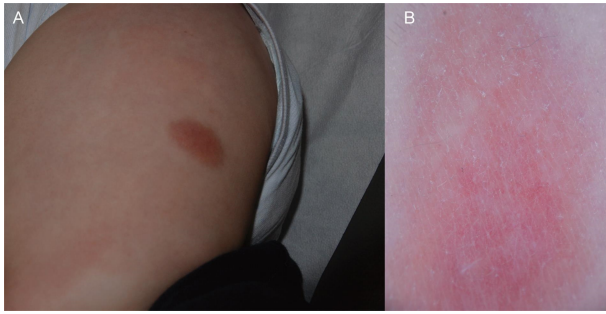
which allow the dermatologist to differentiate it from morphea or vitiligo and reduce the need for invasive diagnostic procedures, namely, biopsy. The most prominent dermoscopic sign is the structureless white or yellow areas, accompanied by chrysalis-like structures, linear irregular vessels, perifollicular scaling, keratotic plugs, and white rosettes [25] (Figure 10). Dermoscopy can also aid in the determination of disease duration and the assessment of treatment outcome. The association between the vascular pattern and the duration of LS is uncertain. Some scientists suggest that dotted vessels correspond to the early stages of vulvar LS, whereas in later stages, dermal fibrosis is more prominent and may lead to poor visibility of the dotted vessels [26]. It has also been suggested that the disappearance of red globules or dots or well-circumscribed purpuric patches is a positive indicator for the response to treatment of vulvar LS [26].

### 3.6 | Cutaneous Mastocytosis

Cutaneous mastocytosis (CM) occurs more frequently in children compared to adults [27]. There are three main subtypes of CM. The most common subtype, maculopapular CM, encompasses urticaria pigmentosa and telangiectasia macularis eruptiva perstans (TMEP) [27]. In urticaria pigmentosa, the most frequent dermoscopic finding is brown reticular lines, whereas in the TMEP, a rarer variant, thin reticular telangiectasias, erythematous background, and brown reticular lines [27]. The second subtype of CM is solitary mastocytoma of the skin, which is characterized by a yellowish-whitish central structureless area, accompanied by brown reticular lines (Figure 11). The third subtype, diffuse cutaneous mastocytosis (DCM), has been poorly described in dermoscopy. One paper reported diffuse yellowish thickening of the skin resembling a “leathery pattern” with areas of translucent vesiculation, and in the area of Darier’s sign, linear microvesiculations on an erythematous background were observed [28]. The reticular vascular pattern has been shown to have a clinical correlation. It is more frequently associated with higher serum baseline tryptase concentrations and with the need for the daily antimedator therapy compared to other dermoscopic signs [29]. Dermoscopy also aids in the monitoring of solitary mastocytoma; lesions in regression usually do not exhibit yellow-orange areas, but more frequently the diffuse light-brown areas and/or brown network [11].



**FIGURE 10** | Lichen sclerosus in a child. (A) Whitish-pinkish macules in the vulvar area; (B) on dermoscopy, a whitish area, follicular plugs, and linear vessels.



**FIGURE 11** | Solitary mastocytoma. (A) Clinical image after eliciting the Darier's sign; (B) on dermoscopy, the classic brownish to yellow coloration may be replaced by erythema and subtle vessels.

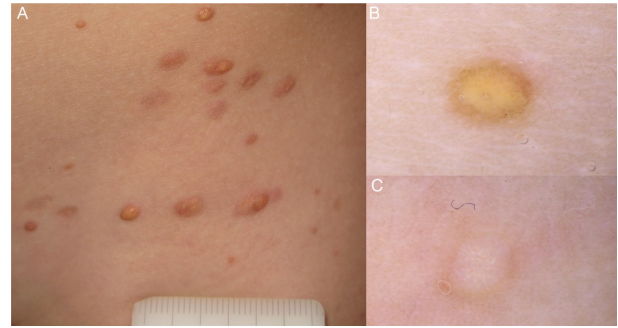
### 3.7 | Juvenile Xanthogranuloma

Juvenile xanthogranuloma (JXG) is the most frequent subtype of non-Langerhans histiocytosis, and up to 70% of cases appear in the first year of life [30]. Dermoscopy enables differentiation from other dermatoses and avoiding unnecessary surgical procedures, considering the tendency of JXG to resolve [31]. The classic dermoscopic image of JXG is compared to a setting sun, because there is a central structureless orangish-yellowish area observed, surrounded by an erythematous halo [31]. However, this sign is not always apparent. Other findings, such as scaling, whitish streaks, inverse network, rosettes, and ulcerations, may be present [30]. Based on dermoscopy, we can distinguish three clinical-dermoscopic evolutionary phases, including the occurrence (setting sun), the stabilization (yellow without red), and the regression (when the white color predominates) (Figure 12). Linear vessels are probably more frequently observed at early and developed stages of JXG evolution, but not in the later phases, and correspond to rapid growth associated with necrosis and scarring [32].

### 3.8 | Cicatricial and Noncicatricial Hair Loss

Dermoscopy of the scalp, namely, trichoscopy, is obviously a mandatory procedure in the diagnostics and treatment follow-up of all alopecia types. In cicatricial alopecias, trichoscopy enables especially the visualization of the scarring progression, scaling severity, and blood vessel morphology.

Among noncicatricial alopecia types, alopecia areata (AA) is a disease that may occur at any age, but approximately 60% of patients experience AA before the age of 20 [33]. The features of active and inactive AA have been very well described [34]. In the active phase, we encounter exclamation mark hairs, broken hairs, black dots, and Pohl-Pinkus constrictions, whereas in the inactive stage, we encounter yellow dots and short vellus hairs [34] (Figure 13A,B). Moreover, it has been shown that in patchy AA, upright regrowing hairs and pigtail hairs are positive predictive markers, whereas black dots, broken hairs, exclamation mark hairs, and tapered hairs are negative markers of hair regrowth [35]. UV-enhanced dermoscopy may provide a better visualization of hair follicles, namely, orangish/reddish or yellowish/whitish fluorescence. It helps to identify the residual follicular activity. Of note, this observation is less prominent in children, due to lower sebum secretion [36] (Figure 13C).

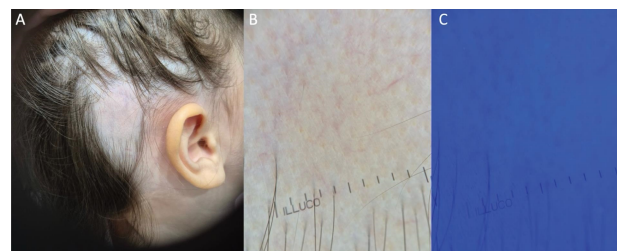


**FIGURE 12** | Juvenile xanthogranuloma. (A) Clinical image of yellowish-orangish nodules; (B), (C) dermoscopic images; juvenile xanthogranuloma may exhibit different dermoscopic patterns according to the evolutionary stage; (B) “setting sun” appearance is seen in the initial phase of the disease; (C) in the regressive phase, white color predominates.

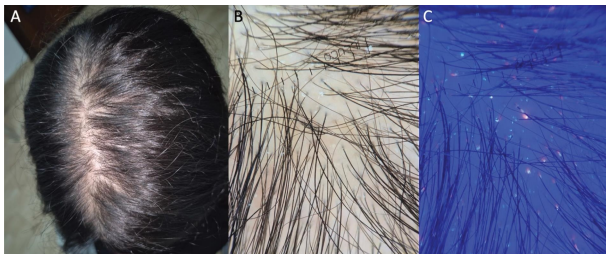
Trichoscopy also allows for monitoring of the hair shaft heterogeneity and visualization of the peripilar sign in case of androgenetic alopecia (Figure 14A,B). On UV-enhanced dermoscopy, the main finding is the follicular pink-red fluorescence, followed by the green fluorescence, as well as dark areas—perifollicular or irregular confluent (Figure 14C) [37].

Another important noncicatricial alopecia type in children is trichotillomania, which is characterized by the impulsive pulling of hair shafts from the scalp or other body areas, not associated with another pre-existing medical condition [38]. Its prevalence is for sure underestimated, but in the past, it was reported between 1% and 3.5% population [39]. There have been several trichoscopic findings described in trichotillomania, of which the hook hairs (question mark hairs) are associated with 100% specificity and positive predictive value. Other characteristic signs (in descending order of specificity and positive predictive value) are coiled hairs, V-sign, hair powder, trichoptilosis, flame hairs, tulip hairs, broken hairs, and black dots [38] (Figure 15A,B).

Trichoscopy is also very helpful in differentiating between AA, trichotillomania, and tinea capitis [1], which all occur frequently in children, and all of them can manifest clinically as patchy hair loss. Tinea capitis is discussed in a separate paragraph in the section on infectious diseases.



**FIGURE 13** | Alopecia areata. (A) Clinical presentation of an alopecic patch with only apparently unlesional skin; (B) trichoscopic image: alopecic patch with yellow dots; (C) trichoscopic image with the UV dermoscopy mode: better visualization of empty hair follicles without the hair shafts.

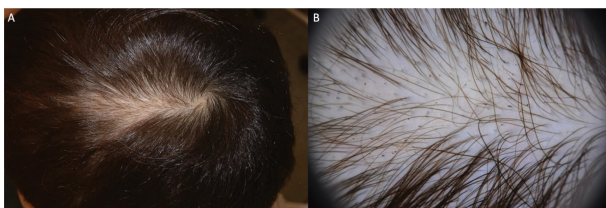


**FIGURE 14** | Androgenetic alopecia. (A) Clinical presentation: wide hair parting; (B) trichoscopic image without the UV mode: heterogeneity of hair shafts' width and single hair shafts within the follicles; (C) trichoscopic image with the UV mode: pink-red and green follicular fluorescence.

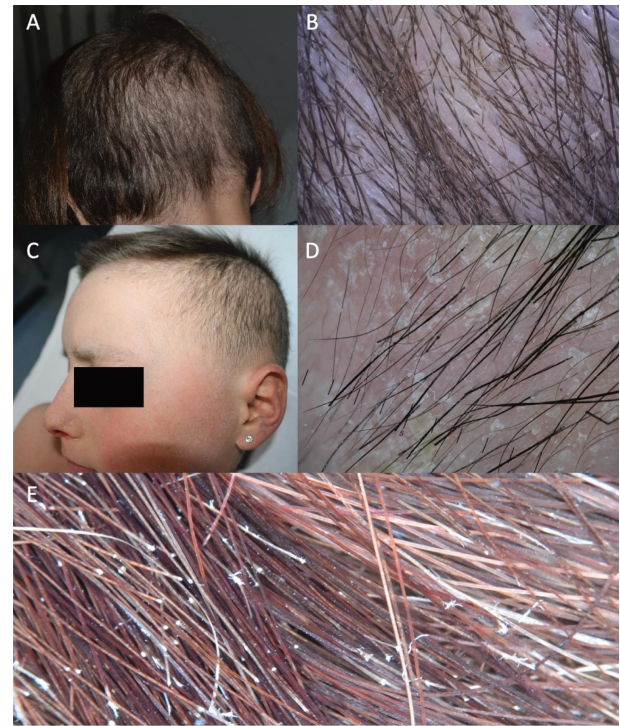
Trichoscopy also allows for assessing the hair shaft disorders. Monilethrix is a hereditary, highly characteristic abnormality in hair shaft morphology. Children who exhibit monilethrix are characterized by short, fragile hair beginning in early childhood; however, the problem seems to improve with age. Monilethrix manifests as variation in hair shaft thickness, namely, uniformly distributed nodosities (normal hair shaft thickness) and intermittent constrictions (thin hair shaft) (Figure 16A). Monilethrix should be distinguished from pseudo-monilethrix, which presents with irregularly distributed, square-shaped flattening of hair shafts, and is acquired (considered an artefact or occurring due to excessive hair styling), as well as from monilethrix-like hairs, which also exhibit constrictions along the hair shaft, but are irregularly distributed. They may occur in AA, chemotherapy-induced alopecia, cicatricial alopecias, or monilethrix-like congenital hypotrichosis or result from hair styling [40].

Trichorrhexis invaginata (bamboo hair) is another characteristic abnormality of the hair shaft morphology, which occurs due to the invagination of the hair shaft in several areas along the shaft, which is observed in trichoscopy as small, irregularly distributed nodules (Figure 16B). When a bamboo hair fractures and forms a cupped proximal end, it is called golf tee hair. They are both pathognomonic for Netherton syndrome [40].

Trichorrhexis invaginata has to be distinguished from trichorrhexis nodosa, which is an abnormality where the hair shaft divides lengthwise into multiple fine strands within a localized segment. On trichoscopy, they also resemble small nodules (Figure 16C). Trichorrhexis nodosa may be inherited and associated with other syndromes; it may also be a single finding, or it may be acquired due to physical/chemical trauma, zinc or biotin deficiency, or associated with hypothyroidism, seborrheic dermatitis, scalp pruritus, and dysesthesia [40].



**FIGURE 15** | Trichotillomania. (A) Clinical presentation: alopecic patch in the parietal region; (B) trichoscopic image: hairs broken at different lengths, coiled hairs, tulip hairs, and black dots.

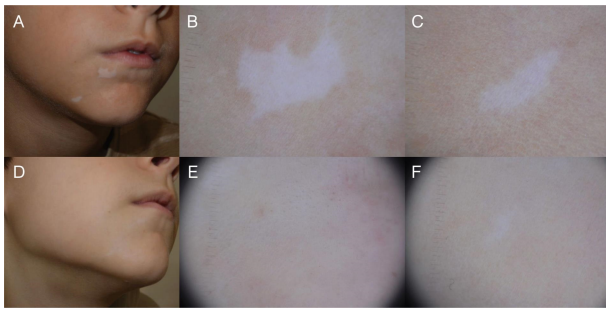


**FIGURE 16** | Hair shaft disorders. (A) Clinical picture of a child with monilethrix; (B) trichoscopic image of monilethrix; (C) clinical picture of a child with Netherton syndrome; (D) trichoscopic image of trichorrhexis invaginata; (E) trichorrhexis nodosa.

Pili torti is a twisted hair shaft disorder, which may be congenital or acquired. Congenital disorders associated with pili torti may be autosomal recessive ichthyosis with hypotrichosis, Bazex syndrome, Beare syndrome, or Menkes syndrome. On the other hand, acquired causes may include AA, cicatricial alopecias, hair transplantation, recurring trauma, or retinoid therapy [40].

### 3.9 | Vitiligo

Vitiligo may begin at any age, but usually occurs before age 30 [41]. Particularly, segmental vitiligo presents earlier, even in 41.3% of patients under the age of 10. Its course may be unpredictable [41]; hence, early diagnosis and introduction of treatment are crucial. Dermoscopy of vitiligo reveals well-demarcated white areas, and in some cases, white hairs and perifollicular pigmentation (Figure 17A–C). It allows for differentiation from other hypopigmented disorders, for instance, idiopathic guttate hypomelanosis (IGH), nevus depigmentosus, nevus anemicus, pityriasis versicolor, or pityriasis alba, which guides the treatment. IGH is characterized by the so-called “cloudy sky-like” pattern, which means the presence of merging multiple small areas with different shades of white, as well as the “cloudy” pattern, which means round, homogeneous white areas of well-demarcated or poorly defined borders [16]. Nevus depigmentosus manifests with serrated, well-demarcated borders, a pale pigment network, no scaling, and normally colored hair [42, 43]. Nevus anemicus presents differently in contact and noncontact dermoscopy. On noncontact examination, there are fewer vessels visible in the lesional skin with diffuse erythema surrounding the lesion; whereas when pressed with the dermoscope glass, the nevus anemicus blends with the surrounding



**FIGURE 17** | Vitiligo. (A) Initial clinical appearance of depigmented macules; (B), (C) initial dermoscopic image shows a white structureless area; (D) clinical improvement after the treatment; (E), (F) dermoscopy may help in the treatment follow-up of vitiligo, showing discrete repigmentation, in particular in the perifollicular areas and reduction of the extension of the hypopigmentation.

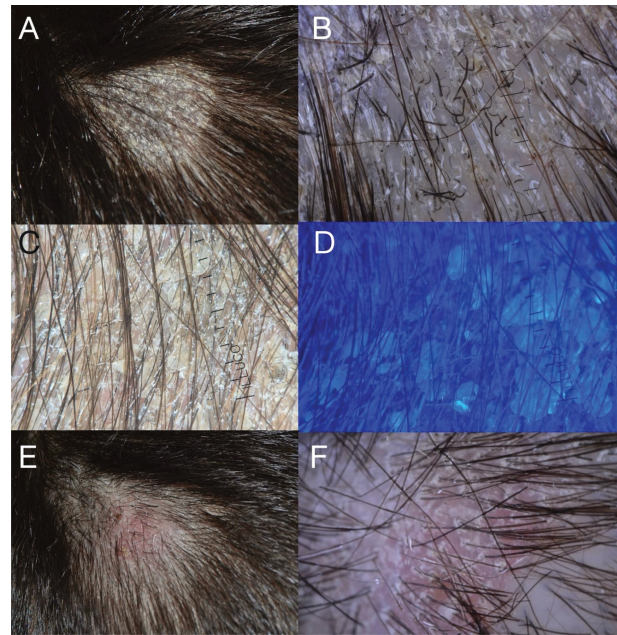
skin with indistinguishable margins, and the linear telangiectasias are more prominent and focused compared to noncontact dermatology [44]. The hypopigmented stage of pityriasis versicolor is characterized by ill-demarcated white areas of diffused hypopigmented blotches, in the majority of cases associated with small white satellite globules, with a pale pigment network, fine scales, and erythematous areas (within and at the border of the macules), with normally colored hair, covered with scales [42, 43]. Pityriasis alba exhibits somewhat similar dermoscopic features to pityriasis versicolor, namely, white ill-demarcated areas with fine scales and normally colored hair [43].

Moreover, finding perifollicular pigmentation in vitiligo indicates repigmentation and progressing lesions compared to stable ones [16] (Figure 17D–F). These findings are also better visualized on UV dermoscopy [45].

## 4 | Infectious Diseases

### 4.1 | Tinea Capitis

Children are statistically more frequently affected by tinea capitis than adults, which is attributed to the increased secretion of sebum after puberty [46]. There are lots of trichoscopic signs that are truly characteristic of tinea capitis (Figure 18A,B). The features that are significantly indicative of tinea capitis are comma hairs, corkscrew hairs, zig-zag hairs, Morse code-like hairs, bent hairs, black dots, and diffuse scaling [47]. Based on trichoscopy, we can conclude about the origin of tinea. Corkscrew hairs are the only sign that has been proven to be significantly more frequent in tinea caused by *Trichophyton*. On the contrary, zig-zag hairs, bent hairs, and Morse code-like hairs are found significantly more frequently in *Microsporum* tinea [47]. Moreover, UV dermoscopy shows bright blue and dull green fluorescence (Figure 18C,D) [14]. Therefore, oral treatment can be adjusted to the suspected pathogen. After the successful treatment of tinea, the described signs should resolve, however, in a particular order (Figure 18E,F). After 4–12 weeks from the treatment introduction, we should observe the disappearance of comma, corkscrew, zig-zag, Morse code-like, and broken hairs, as well as black dots. On the contrary, scaling may persist and disappear more slowly [47].



**FIGURE 18** | Tinea capitis. (A) Clinically visible alopecic patch before starting the treatment; (B) trichoscopy reveals comma hairs, zig-zag hairs, bent hairs, and scaling; (C) trichoscopic image without the UV mode; (D) trichoscopic picture with the UV mode showing the dull green fluorescence; (E) clinical image after the treatment; (F) trichoscopy after the treatment, all the typical features disappear apart from scaling that may still be visible even after 12 weeks.

### 4.2 | Tinea Corporis

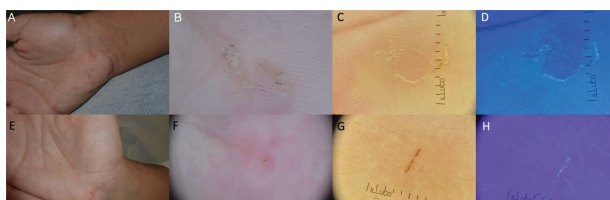
Tinea corporis (ringworm) also affects children more frequently compared to adults [48]. Dermoscopy of tinea corporis reveals white scales on the border of the pink background, with a centrifugal scaling pattern (Figure 19). The type of treatment (topical/oral) depends on the severity and localization of lesions; however, reports suggest that finding black dots surrounded by a pale whitish halo in dermoscopy indicates the involvement of vellus hair and implies the necessity for systemic antifungal treatment [1].

### 4.3 | Scabies

Children are susceptible to scabies; the highest prevalence is noted under the age of 2, especially in tropical countries [49]. The dermoscopic features of scabies are remarkably characteristic and enable easy diagnosis even in cases of atypical clinical presentation. The hallmark of scabies is the so-called delta wing jet with contrail, which corresponds to a whitish angulated line (a burrow) with a small brown triangle at the end (a mite) (Figure 20A,B) [1]. UV dermoscopy enables a better visualization of burrows, eggs, and the body of the mite with the “ball sign” and a novel finding, namely, scabies exit holes distributed along the burrow path (Figure 20C,D) [50]. After the proper treatment of scabies, the delta wing jet with contrail sign should disappear, even if an uninhabited burrow may be found (Figure 20E,F). The use of UV dermoscopy is also important in the follow-up after treatment, showing the disappearance of typical findings described above and the absence of exit holes in lesions secondary to residual scratching (Figure 20G,H).



**FIGURE 19** | Tinea corporis (ringworm). (A) Clinical presentation with ring-shaped erythematous-scaly lesions with pustules; (B) dermoscopy reveals micropustules and the inner border of scaling.



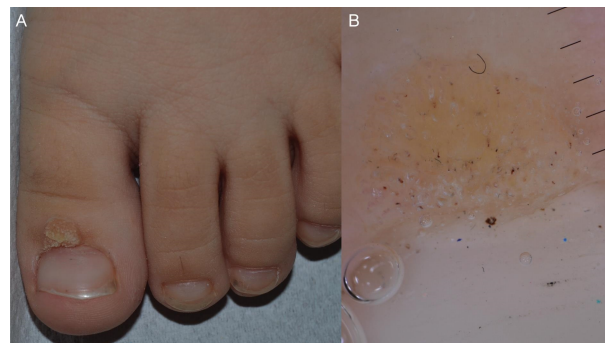
**FIGURE 20** | Scabies. (A) Clinical presentation with several papules and excoriations before the treatment; (B) before the treatment, dermoscopy reveals a typical jet with contrail sign; (C) dermoscopic image without the UV mode; (D) dermoscopic image with the UV mode enabling a better visualization of a burrow and the body of the mite with the “ball sign”; (E) clinical resolution of skin lesions after the treatment; (F) dermoscopy may be the proof of complete clearance of the lesions, thus showing no residual burrows and mites; (G) dermoscopic image without the UV mode after the treatment; (H) dermoscopic image with the UV mode after the treatment enabling a better visualization of excoriations without the burrows.



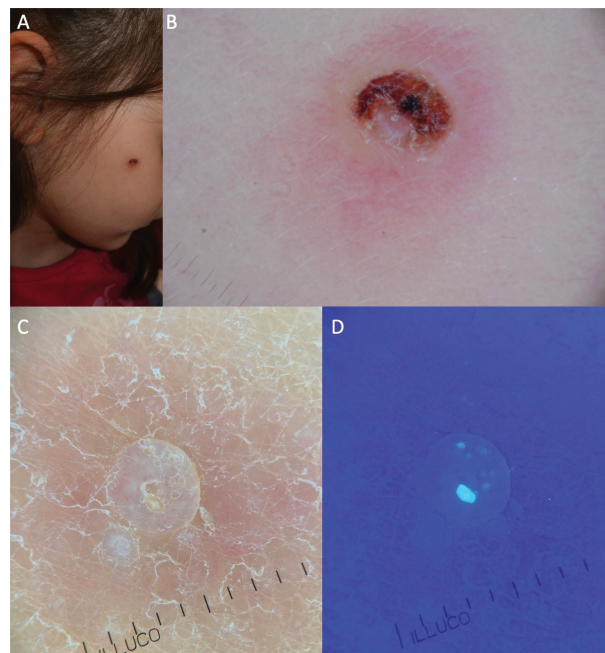
**FIGURE 21** | Head lice: full and empty nits are seen on trichoscopy.

#### 4.4 | Head Lice

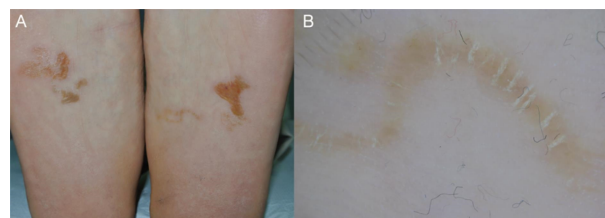
Head lice is a very common infestation, particularly in the pediatric population. Dermoscopy is especially an important tool in case of nits, when mature lice are not clearly found. Nits are oval structures attached to the hair shaft. When they are vital, they are brown and have an ovoid shape. When they are empty and inactive, they are whitish and translucent and have a sharp free



**FIGURE 22** | Viral wart. (A) Clinical presentation of an exophytic lesion with rough surface; (B) dermoscopy reveals typical hemorrhagic dots surrounded by white halos.



**FIGURE 23** | Molluscum contagiosum. (A) Clinical image of an inflamed nodule; (B) along with erythema and crusting, a residual white amorphous area is still recognizable, and other two smaller lesions are still visible on the left side of the picture; (C) dermoscopic picture without the UV mode with poorly visible orifice; (D) dermoscopic image with the UV mode clearly visualizing the orifice in the center.



**FIGURE 24** | Cutaneous larva migrans. (A) Clinical image of orangish-brownish serpiginous elevated lesions; (B) dermoscopy shows typical reddish-pinkish structureless areas of a linear or serpiginous shape and multiple translucent segmental pale yellow structureless areas, separated by white-yellow lines matching the body of the larva.

**TABLE 1** | The table summarizes the main dermoscopic findings that enable the diagnosis, as well as findings that may indicate a change in the lesion or influence therapeutic decisions.

<b>Diseases</b>	<b>Diagnostic clues</b>	<b>Clues suggesting evolution/influence on therapeutic decisions</b>
Infantile hemangiomas	<ul style="list-style-type: none"> <li>Well-demarcated, oval structures composed of red lacunae or lakes of blood</li> <li>White septae</li> </ul>	<ul style="list-style-type: none"> <li>Superficial hemangiomas: bright red; deep lesions: blue or violet</li> <li>Visualization of the impending ulceration: white color</li> </ul>
Vascular malformations	<ul style="list-style-type: none"> <li>Port-wine stain malformations: dots, globules, and a broken network of thick and/or thin vessels</li> <li>Angiokeratomas: red, purple, or even brownish lacunae with blue-whitish veil</li> <li>Angioma serpiginosum: multiple small oval red lacunae</li> <li>Venous malformations: violet or blue, poorly defined, structureless areas with arborizing linear, and irregular vessels</li> <li>Lymphatic malformations: yellow to light brown lacunae separated by pale septa with a “hypopyon-like” image</li> <li>Arteriovenous malformations: reticular pigmentation with reticular vessels</li> </ul>	<ul style="list-style-type: none"> <li>Superficially located vessels associated with a good response to therapy with pulsed dye laser</li> <li>White linear structures within a pink, white, or blue background, as well as pale halos surrounding central comedo-like structures, are associated with a worse response to therapy</li> </ul>
Psoriasis	<ul style="list-style-type: none"> <li>Evenly distributed dotted vessels on a pink background, covered with white-silverish scales</li> <li>Red fluorescence with a peripapillary distribution on UV dermoscopy</li> </ul>	<ul style="list-style-type: none"> <li>During proper treatment, a reduction of vessels occurs, including a decrease in their diameter and tortuosity</li> <li>Hemorrhagic dots occurrence is a positive predictive sign of a response to biological therapy (usually appearing after 2-4 weeks)</li> <li>Residual dotted vessels in psoriasis-induced hypopigmented macules support of the diagnosis</li> <li>Differentiation between psoriasis and seborrheic dermatitis in isolated doubtful scalp lesions</li> </ul>
Atopic dermatitis	<ul style="list-style-type: none"> <li>Bright red background with irregularly or patchily distributed dotted vessels</li> <li>Yellow scaling</li> <li>Serocrusts</li> <li>Hemorrhagic dots</li> </ul>	<ul style="list-style-type: none"> <li>Dermoscopic signs change or resolve after the application of emollients and topical steroids</li> <li>After the treatment with dupilumab, the vessels are distributed homogeneously and exhibit a smaller caliber, erythema, and scaling</li> <li>Monitoring of topical steroid side effects</li> </ul>
Lichen planus	<ul style="list-style-type: none"> <li>Shiny silverish-whitish crossed lines on a pinkish-reddish background</li> <li>Dotted, globular, or linear vessels at the border of the lesion</li> </ul>	<ul style="list-style-type: none"> <li>Early stages: less prominent Wickham striae on an erythematous background</li> <li>Mature lesions: striae become more pronounced and peripheral blood vessels become visible</li> <li>Over time, both the striae and vessels tend to diminish</li> </ul>

(Continues)

TABLE 1 | (Continued)

Diseases	Diagnostic clues	Clues suggesting evolution/influence on therapeutic decisions
Pityriasis lichenoides	<p>PLEVA</p> <ul style="list-style-type: none"> <li>• Early lesions: structureless brownish area with white scales and dotted vessels at the periphery</li> <li>• Late stages: the central crust on a white structureless area, white scaling, and hemorrhagic dots</li> </ul> <p>PLC</p> <ul style="list-style-type: none"> <li>• Focally distributed dotted or arborizing vessels and milky-red globules on an orange-yellow structureless background</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation between PLEVA and PLC: targetoid lesions more indicative of PLEVA, whereas superficial scaling on a light brown background is more indicative of PLC</li> <li>• Differentiation between early and late lesions in PLEVA</li> </ul>
Lichen sclerosus	<ul style="list-style-type: none"> <li>• Structureless white or yellow areas</li> <li>• Chrysalis-like structures</li> <li>• Linear irregular vessels</li> <li>• Perifollicular scaling</li> <li>• Keratotic plugs</li> <li>• White rosettes</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation between LS and morphea or vitiligo</li> <li>• Dotted vessels correspond with early stages of vulvar LS</li> <li>• Late stages: dermal fibrosis and poor visibility of the dotted vessels</li> <li>• Disappearance of red globules or dots or well-circumscribed purpuric patches, positive indicator for the response to treatment of vulvar LS</li> </ul>
Cutaneous mastocytosis	<ul style="list-style-type: none"> <li>• Urticaria pigmentosa: brown reticular lines</li> <li>• TMEP: thin reticular telangiectasias, erythematous background, and brown reticular lines</li> <li>• Solitary mastocytoma: yellowish-whitish central structureless area, accompanied by brown reticular lines</li> <li>• DCM: diffuse yellowish thickening of the skin resembling a “leathery pattern” with areas of translucent vesiculation</li> </ul>	<ul style="list-style-type: none"> <li>• Reticular vascular pattern associated with higher serum baseline tryptase concentrations and with the need for the daily antimediator therapy</li> <li>• Monitoring of solitary mastocytoma: lesions in regression usually do not exhibit yellow-orange areas, but more frequently exhibit the diffuse light-brown areas and/or brown network</li> </ul>
Juvenile xanthogranuloma	<ul style="list-style-type: none"> <li>• Setting sun: central, structureless orangish-yellowish area surrounded by an erythematous halo</li> <li>• Scaling</li> <li>• Whitish streaks</li> <li>• Inverse network</li> <li>• Rosettes</li> <li>• Ulcerations</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation from other dermatoses and avoiding unnecessary surgical procedures</li> <li>• Early stages: setting sun</li> <li>• Stabilization: yellow without red</li> <li>• Regression: prominent white color</li> </ul>
Vitiligo	<ul style="list-style-type: none"> <li>• Well-demarcated white areas</li> <li>• White hairs</li> <li>• Perifollicular pigmentation</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation from other hypopigmented disorders</li> <li>• Perifollicular pigmentation indicates repigmentation and progressing lesions</li> </ul>
Alopecia areata	<ul style="list-style-type: none"> <li>• Active phase: exclamation mark hairs, broken hairs, black dots, Pohl-Pinkus constrictions</li> <li>• Inactive stage: yellow dots, short vellus hairs</li> </ul>	<ul style="list-style-type: none"> <li>• Prediction of hair regrowth: upright regrowing hairs and pigtail hairs serve as positive predictive markers of regrowth; black dots, broken hairs, exclamation mark hairs, and tapered hairs serve as negative markers of hair regrowth</li> </ul>

(Continues)

TABLE 1 | (Continued)

Diseases	Diagnostic clues	Clues suggesting evolution/influence on therapeutic decisions
Androgenetic alopecia	<ul style="list-style-type: none"> <li>• Hair shaft heterogeneity</li> <li>• Peripilar sign</li> <li>• Single hair shafts within the follicles</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation from other types of alopecia</li> <li>• Monitoring of therapy efficacy</li> </ul>
Trichotillomania	<ul style="list-style-type: none"> <li>• Hook hairs</li> <li>• Coiled hairs</li> <li>• V-sign</li> <li>• Hair powder</li> <li>• Trichoptilosis,</li> <li>• Flame hairs</li> <li>• Tulip hairs</li> <li>• Broken hairs</li> <li>• Black dots</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation from other types of alopecia</li> <li>• Monitoring of therapy efficacy</li> </ul>
Tinea capitis	<ul style="list-style-type: none"> <li>• Comma hairs</li> <li>• Corkscrew hairs</li> <li>• Zig-zag hairs</li> <li>• Morse code-like hairs</li> <li>• Bent hairs</li> <li>• Black dots</li> <li>• Diffuse scaling</li> <li>• UV dermoscopy: bright blue and dull green fluorescence</li> </ul>	<ul style="list-style-type: none"> <li>• Defining the origin of tinea: corkscrew hairs are the only sign proven to be significantly more frequent in tinea caused by <i>Trichophyton</i>; zig-zag hairs, bent hairs, and Morse code-like hairs are found significantly more frequent in <i>Microsporum</i> tinea</li> <li>• After the successful treatment of tinea, the described signs resolve</li> </ul>
Tinea corporis	<ul style="list-style-type: none"> <li>• Scales on the border, centrifugal scaling pattern</li> <li>• Pink background</li> </ul>	<ul style="list-style-type: none"> <li>• Black dots surrounded by a pale whitish halo indicates the involvement of vellus hair, which signals the need for systemic antifungal treatment</li> </ul>
Scabies	<ul style="list-style-type: none"> <li>• Delta wing jet with contrail</li> <li>• UV dermoscopy: better visualization of burrows, eggs, and the body of the mite with the “ball sign”</li> </ul>	<ul style="list-style-type: none"> <li>• After the proper treatment, the delta wing jet with contrail sign should disappear, even if an uninhabited burrow may be found</li> </ul>
Head lice	<ul style="list-style-type: none"> <li>• Visualization of mature lice or nits (oval structures attached to the hair shaft)</li> <li>• “Glowing crab louse sign” on UV dermoscopy</li> </ul>	<ul style="list-style-type: none"> <li>• Vital nits: brown, ovoid shape</li> <li>• Inactive nits: whitish, translucent, sharp free edge</li> <li>• Differentiation between nits and scales due to scaling scalp dermatoses</li> </ul>
Viral warts	<ul style="list-style-type: none"> <li>• Structureless brownish-pinkish or flesh-colored area</li> <li>• Breaks in dermatoglyphics</li> <li>• Hemorrhagic dots</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation of viral warts from other dermatoses</li> <li>• Assessing treatment efficacy: after the treatment, even if the lesion seems to be clinically absent, it can be visualized under magnification</li> <li>• Response to cryotherapy: common warts respond favorably when they exhibit visible blood vessels and prominent scaling on the surface; plantar warts respond favorably when they exhibit background erythema</li> </ul>

(Continues)

**TABLE 1** | (Continued)

Diseases	Diagnostic clues	Clues suggesting evolution/influence on therapeutic decisions
Molluscum contagiosum	<ul style="list-style-type: none"> <li>• Orifice in the center</li> <li>• If orifice not clearly visible, better visualization can be achieved using UV dermatoscopy</li> <li>• Surrounded by vessels</li> <li>• Pinkish background</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiation from other dermatoses</li> <li>• Punctiform vessels are more frequent when scratching or other irritations of the lesion occur</li> </ul>
Cutaneous larva migrans	<ul style="list-style-type: none"> <li>• Reddish-pinkish structureless areas of a linear or serpiginous shape</li> <li>• Multiple translucent segmental pale yellow structureless areas, separated by white-yellow lines</li> </ul>	<ul style="list-style-type: none"> <li>• After the successful treatment, lesions become paler, presenting as brown, structureless areas in the background along the burrow and erythema becomes less visible</li> <li>• If the burrow is empty, dotted vessels are observed along the track</li> </ul>

edge (Figure 21). Trichoscopy also enables differentiation between nits and scales due to scaling scalp dermatoses, such as psoriasis or seborrheic dermatitis [1]. A recent finding is a “glowing crab louse sign” described in UV dermatoscopy, meaning a bright blue fluorescence emitted by the whole parasite [51].

#### 4.5 | Viral Warts

Viral warts, especially common and plantar, are characterized by the presence of a structureless brownish-pinkish or flesh-colored area, which causes breaks in dermatoglyphics, and on the surface, hemorrhagic dots are found, which correspond to thrombosed vessels (Figure 22) [1]. Dermoscopy enables differentiation of viral warts from the callosities, tylomas, or hyperkeratotic cases of eczema, as well as the assessment of treatment efficacy, and provides some clues about the potential response to therapy. It has been reported that common warts tend to respond well to cryotherapy when they display visible blood vessels and prominent scaling on the surface, whereas plantar warts exhibit better outcomes when background erythema is present [52]. It happens frequently that after the treatment, the lesion seems to be clinically absent, whereas, thanks to dermatoscopy, it can be visualized under magnification. Particularly, the hemorrhagic dots are clear signs of the wart persistence. Dermoscopy may also be helpful after minor treatments of warts to establish whether the lesions are completely removed or not.

#### 4.6 | Molluscum Contagiosum

Molluscum contagiosum (MC) is a very common viral infection in the pediatric population. Despite its distinctive clinical appearance, some cases may be atypical and challenging, and in such instances, dermatoscopy provides an accurate diagnosis. Dermoscopic image of MC usually exhibits an orifice in the center, surrounded by vessels, on a pinkish background. Several vascular patterns have been described: crown, radial, punctiform, their combinations, or no vessels at all (Figure 23A,B). Cases without orifice may also occur [1, 53]; however, UV-enhanced dermatoscopy may aid in better visualization (Figure 23C,D) [54]. In some cases, before the regression of the lesion, it becomes inflamed and dermatoscopy reveals a punctiform vascular pattern [53]. Scratching or other irritations of the lesion also lead to a higher probability of punctiform vessel occurrence [53]. Similar to warts, dermatoscopy may be used to assess the efficacy of molluscum procedural removal.

#### 4.7 | Cutaneous Larva Migrans

Cutaneous larva migrans occurs much more rarely and usually in endemic areas or in tourists returning from such regions, and although the clinical presentation is very distinct, dermatoscopy allows for the determination of therapy progress and whether the burrow is empty or not. The initial examination shows reddish-pinkish structureless areas of a linear or serpiginous shape, which correspond to the burrow created by the larva (Figure 24) [55]. There are also multiple translucent segmental pale yellow structureless areas, separated by white-yellow lines matching the body of the larva [55]. After the successful treatment, the lesions become paler, there are brown, structureless areas in the background along the burrow, and the erythema is less visible

[55]. If the burrow is empty, there are dotted vessels observed along the track [1]. Hemorrhagic crusting occurs [55].

The summary of the main dermoscopic findings that enable the diagnosis, as well as findings that may indicate a change in the lesion or influence therapeutic decisions, can be found in Table 1.

## 5 | Conclusions

Dermoscopy is an ideal tool to use in the pediatric population due to its noninvasive and painless character. Not only does it allow for the correct diagnosis without the need for an invasive procedure, but it also aids in the choice of appropriate treatment or provides prognostic information.

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### Conflicts of Interest

The authors declare no conflicts of interest.

### Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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