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Dermoscopy in Tinea Capitis/Barbae and Tinea of Glabrous Skin: A Comparative Analysis Between Polarized and Ultraviolet-Induced Fluorescence Examination to Differentiate *Microsporum* From *Trichophyton* Infections

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Dear Editor,

Microsporum and *Trichophyton* species are the main etiological agents of tinea capitis/barbae and tinea of glabrous skin [1, 2]. Importantly, such dermatophytes present significant differences in terms of hair invasion pattern, infection spreading rate, and sensitivity to antifungal agents [1, 2]. In particular, *Microsporum* spp. typically grow within the hair follicle and cover the surface of the hair shaft (ectothrix invasion), with consequent higher tendency to infection spreading, whereas *Trichophyton* spp. generally grow within the hair shaft only (endothrix invasion), thus being less contagious [1, 2]. Moreover, *Microsporum* spp. better respond to griseofulvin and often need a longer treatment, while *Trichophyton* spp. are more sensitive to terbinafine and itraconazole [1]. Accordingly, their distinction is important, yet such information usually requires time as mycological cultures are typically incubated for 4 weeks or longer [1, 2]. In this regard, dermoscopy has been showed to help discriminate between *Microsporum*- and *Trichophyton*-related tinea capitis based on dystrophic hairs subtypes, with "Morse-code"/"zig-zag" hairs being characteristic for the former and corkscrew hairs/black dots being more typical for the latter, albeit they are not pathognomonic as overlaps have been reported [3–5].

In this retrospective observational study, we compared for the first time the accuracy of polarized and ultraviolet-induced fluorescence (UVF) dermoscopy (peak wavelength 365 nm, Dermlite DL5, USA) in differentiating *Microsporum* from *Trichophyton* infections involving hairy skin (tinea capitis/barbae) and non-hairy skin (i.e., tinea corporis, cruris, faciei, and manuum); tinea pedis was not considered as it is mainly due to *Trichophyton rubrum*, while onychomycosis was out of the aim of this analysis; patients treated within 6 weeks before examination were ruled out. In detail, we included 41 subjects [23F/18M, phototypes—II: 5, III: 18, IV: 8, V: 5, VI: 5; mean age 31.6 years] with tinea infections confirmed by fungal culture: 13 tinea capitis/barbae (seven due to *Microsporum* spp. and six to *Trichophyton* spp.) and 28 tinea of glabrous skin (11 due to *Microsporum* spp. and 17 to *Trichophyton* spp.); see Table 1 for further details on clinical subtypes. All the images were randomly evaluated by two independent experienced investigators, blinded to clinical/etiological data, for the presence of green fluorescence on UVF-dermoscopy and predefined criteria on polarized-dermoscopy [6, 7]; interobserver agreement was evaluated for both polarized and UVF dermoscopic pictures through Cohen's kappa coefficient. Afterwards, a second meeting between evaluators to reach a consensus was performed, with the final decision to mark as present/absent based on unanimous agreement. Fisher's exact test with p-value set at 0.05 was used for comparative analyses. Hybrid (polarized/UVF) handheld

TABLE 1 | Dermoscopy of tinea infections (capitis/barbae and glabrous skin) (total cases: 41): Comparative analysis between instances due *Microsporum* spp. and *Trichophyton* spp. analyzed by polarized and ultraviolet-induced fluorescence (UVF) dermoscopy.

Tinea capitis/barbae[a] ($n=13$)			
Dermoscopic setting	**Dermoscopic findings of instances due to *Microsporum* spp. (prevalence) ($n=7$)[b]**	**Dermoscopic findings of instances due to *Trichophyton* spp. (prevalence) ($n=6$)[b]**	**p[c]**
Polarized[d]	White scales (100.0%)	White scales (100.0%)	1.000
	Perifollicular (85.7%)	Perifollicular (33.3%)	0.103
	Interfollicular (57.1%)	Interfollicular (71.4%)	0.559
	Yellow scales (28.6%)	Yellow scales (0.0%)	0.462
	Interfollicular (28.6%)	Interfollicular (0.0%)	0.462
	Dystrophic hairs (100.0%)	Dystrophic hairs (83.3%)	0.462
	Corkscrew hairs (42.9%)	Corkscrew hairs (33.3%)	1.000
	Comma hairs (42.9%)	Comma hairs (33.3%)	1.000
	Black dots (57.1%)	Black dots (50.0%)	1.000
	Short-broken hairs (85.7%)	Short-broken hairs (50.0%)	0.266
	"Morse code" hairs (14.3%)	"Morse code" hairs (16.7%)	1.000
	Perifollicular pustules (28.6%)	Perifollicular pustules (0.0%)	0.462
Ultraviolet-induced fluorescence	**Green fluorescence (100.0%)**	Green fluorescence (0.0%)	**0.001**
	Follicular/peripilar (71.4%)	Follicular/peripilar (0.0%)	**0.021**
	Interfollicular (28.6%)	Interfollicular (0.0%)	0.462
Tinea of glabrous skin[a] ($n=28$)			
Dermoscopic setting	**Dermoscopic findings of instances due to *Microsporum* spp. (prevalence)[b] ($n=11$)**	**Dermoscopic findings of instances due to *Non-Microsporum* spp. (prevalence)[b] ($n=17$)**	**p[c]**
Polarized[d]	Dotted vessels (54.5%)	Dotted vessels (35.3%)	0.441
	Peripheral (45.5%)	Peripheral (29.4%)	0.444
	Unspecific distribution (9.1%)	Unspecific distribution (5.9%)	1.000
	Linear vessels (9.1%)	Linear vessels (0.0%)	0.393
	Peripheral (9.1%)	Unspecific distribution (0.0%)	0.393
	White scales (100.0%)	White scales (100.0%)	1.000
	Perifollicular (45.5%)	Perifollicular (17.6%)	0.200
	In the skin furrows (9.1%)	In the skin furrows (17.6%)	1.000
	Peripheral (72.7%)	Peripheral (64.7%)	0.704
	Patchy (18.2%)	Patchy (17.6%)	1.000
	Yellow scales (18.2%)	Yellow scales (5.9%)	0.543
	Peripheral (18.2%)	Peripheral (5.9%)	0.543
	Dystrophic hairs (45.5%)	Dystrophic hairs (23.5%)	0.409
	Black dots (36.4%)	Black dots (11.8%)	0.174
	Short-broken hairs (45.5%)	Short-broken hairs (11.8%)	0.076
	Follicular pustules (18.2%)	Follicular pustules (5.9%)	0.543
Ultraviolet-induced fluorescence	**Green fluorescence (100.0%)**	Green fluorescence (0.0%)	**<0.001**
	Follicular/peripilar (72.7%)	Follicular/peripilar (0.0%)	**<0.001**
	Unspecific distribution (54.5%)	Unspecific distribution (0.0%)	**0.001**

[a]Tinea capitis/barbae: 11 tinea capitis and two tinea barbae; Tinea of the glabrous skin: 17 tinea corporis; three tinea faciei; five tinea manuum; three tinea cruris.
[b]Values highlighted in bold indicate statistically significant differentiating findings.
[c]$p<0.05$ deemed as statistically significant (analyses performed according to Fisher's exact test).
[d]Tinea capitis/barbae: analysis performed according to parameters proposed by Rudnicka et al. [7]; Tinea of glabrous skin: analysis performed according to the *International Dermoscopy Society* criteria for non-neoplastic dermatoses (Errichetti E, et al. *Br J Dermatol* 2020; 182: 454–67).

dermoscopy (10× magnification) was employed in all instances. In general, the commonest dermoscopic findings (≥50% of cases) on polarized examination in tinea capitis/barbae were white scales (mainly perifollicular in *Microsporum*-related instances and interfollicular in *Trichophyton*-related cases), short-broken hairs and black dots (regardless etiological agent), whereas peripheral white scales (regardless etiological agent) and peripheral dotted vessels (*Microsporum*-related instances) turned out to be present in at least half of the cases of tinea of glabrous skin; for less common features see Table 1. Notably, no statistical difference was found between *Microsporum* and *Trichophyton* infections (for both hairy and non-hairy skin) in terms of polarized dermoscopic findings, although we observed a tendency to have more short-broken hairs in *Microsporum* infections of glabrous skin ($p = 0.076$). Conversely, green fluorescence detected on UVF-dermoscopy was found to be typical for *Microsporum*-related cases ($p < 0.05$), with follicular/peripilar pattern for tinea capitis/barbae and both follicular/peripilar and unspecific distribution for tinea of glabrous skin. Table 1 displays all analytical data/statistical differences, while Figure 1 depicts some examples. Kappa values were 0.81 and 0.89 ("almost perfect" agreement) for polarized and UVF-dermoscopy, respectively.

UVF-dermoscopy is a new imaging technique that has shown to reveal several findings not visible to the naked eye, thus complementing polarized dermoscopic assessment [8]. Accordingly, our study confirms a possible overlap of polarized dermoscopic features between *Microsporum* and *Trichophyton* infections of hairy skin (tinea capitis/barbae) and highlights the lack of discriminating findings also in instances involving glabrous skin. Conversely, UVF-dermoscopy seems to be more accurate to differentiate such dermatophytes subtypes as it shows green fluorescence, possibly linked to pteridine/tryptophan metabolites released by *Microsporum* spp. [9]. Therefore, it might be useful not only on the etiology but also in terms of diagnosis and post-treatment monitoring since subtle instances may lack the typical dermoscopic features [3–5, 10]. This is particularly relevant in children, given the higher prevalence of tinea infections in such a population. The main limitations of the present study include the retrospective design and the limited sample size, therefore future prospective analyses are needed to confirm our findings.

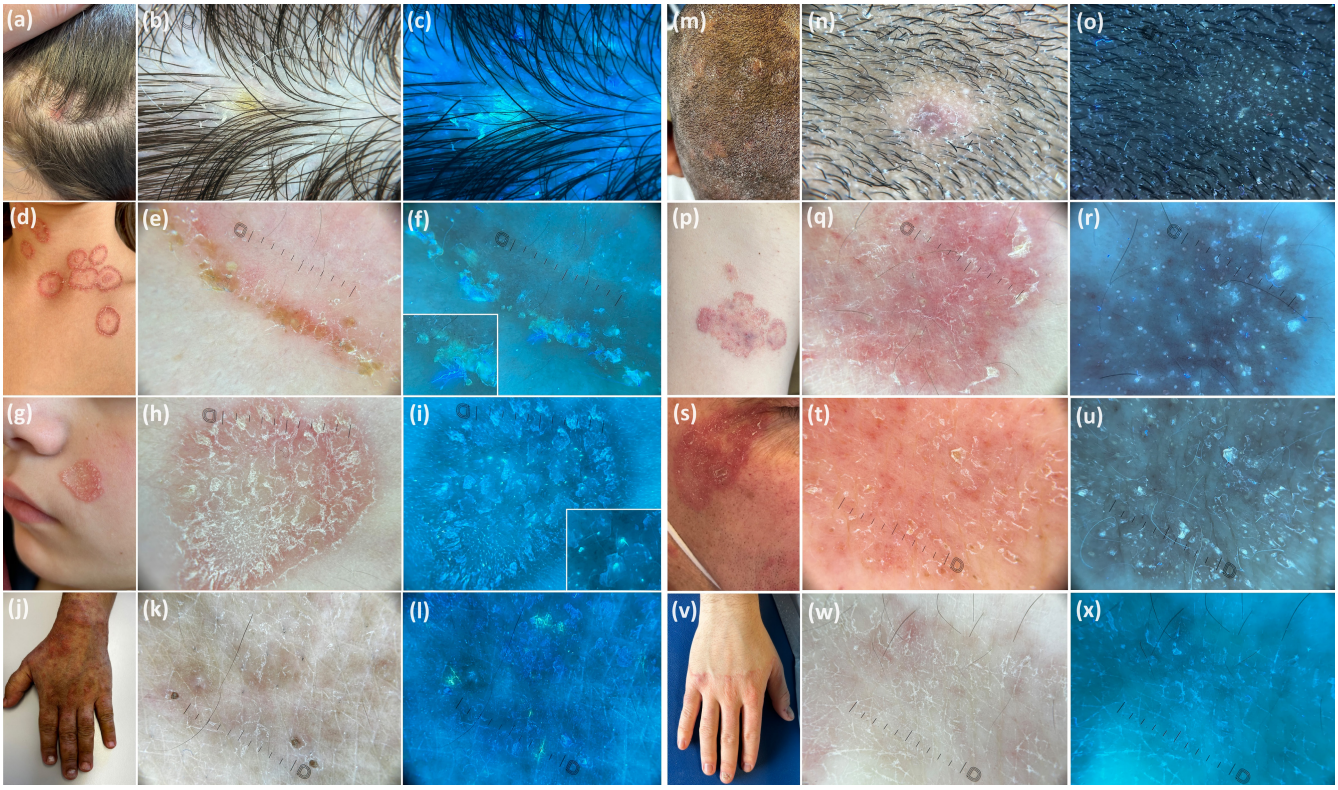

FIGURE 1 | *Microsporum*-related tinea capitis: Clinical image (a); polarized dermoscopy: Few broken hairs (b); UVF-dermoscopy: Peripilar green fluorescence (c). *Microsporum*-related tinea corporis: Clinical image (d); polarized dermoscopy: Peripheral dotted vessels along with peripheral white and yellow scaling (e); UVF-dermoscopy: Green fluorescence with unspecific distribution (better seen in the inset) (f). *Microsporum*-related tinea faciei: Clinical image (g); polarized dermoscopy: Patchy and peripheral white scaling (h); UVF-dermoscopy: Follicular green fluorescence (magnification in the inset) (i). *Microsporum*-related tinea manuum: Clinical image (j); polarized dermoscopy: White scaling in the skin furrows along with black dots (k); UVF-dermoscopy: Multiple areas showing green fluorescence (l). *Trichophyton*-related tinea capitis: Clinical image (m); polarized dermoscopy: Black dots and broken hairs as well as perifollicular white scaling (n); UVF-dermoscopy: No fluorescence (o). *Trichophyton*-related tinea corporis: Clinical image (p); polarized dermoscopy: Patchy and peripheral white scaling along with dotted vessels (unspecific distribution) and few broken hairs (q); UVF-dermoscopy: No fluorescence (r). *Trichophyton*-related tinea faciei: Clinical image (s); polarized dermoscopy: Patchy and peripheral white scaling (t); UVF-dermoscopy: No fluorescence (u). *Trichophyton*-related tinea manuum: Clinical image (v); polarized dermoscopy: White scaling in the skin furrows (w); UVF-dermoscopy: No fluorescence (x).

Author Contributions

All authors have contributed to data collection. Enzo Errichetti has also written the paper.

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Consent

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

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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