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Literature Review

DIAGNOSTIC UTILITY OF TRICHOSCOPY IN TINEA CAPITIS
A Systematic Review of Studies Using Mycological Confirmation

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Abstract

Background: Tinea capitis can mimic alopecia areata, seborrhoeic dermatitis, psoriasis and bacterial folliculitis. Mycological confirmation remains important, but potassium hydroxide microscopy is operator dependent and fungal culture may delay diagnosis. Trichoscopy enables rapid visualisation of characteristic hair-shaft and scalp abnormalities.

Objective: To evaluate the diagnostic utility of trichoscopy in tinea capitis, including diagnostic accuracy, common signs and associations with dermatophyte species.

Methods: Original human studies published from January 2016 to 27 July 2026 were identified through PubMed/MEDLINE, PubMed Central, publisher platforms and citation lists. Eligible studies assessed trichoscopy or scalp dermoscopy and incorporated potassium hydroxide microscopy, fungal culture and/or polymerase chain reaction. Findings were narratively synthesised because of heterogeneity.

Results: Eight studies involving 640 participants were included. One prospective multicentre study reported 94% sensitivity, 83% specificity, 92% positive predictive value and 86% negative predictive value for at least one typical trichoscopic feature. Comma hairs, black dots, broken hairs and scaling were common. Reported species-associated patterns varied across geographic settings.

Conclusion: Trichoscopy is a rapid adjunct for recognising tinea capitis and prioritising mycological testing. It should not replace potassium hydroxide microscopy or fungal culture, while species prediction remains insufficiently reliable for treatment decisions.

Keywords: tinea capitis; trichoscopy; diagnostic accuracy; fungal culture; dermatophytes

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1. INTRODUCTION

Tinea capitis is a dermatophyte infection of the scalp and hair shaft. Its clinical spectrum includes grey-patch alopecia, black-dot alopecia, diffuse scaling, pustular disease and kerion. The supplied referat appropriately identifies trichoscopic findings such as comma hairs, corkscrew hairs, Morse code-like hairs, zigzag hairs, bent hairs, black dots and broken hairs as potentially useful diagnostic clues. The present review narrows that broad clinical discussion to a single systematic question and independently verifies the journal evidence used for every extracted result. [Source referat; 2]

The practical appeal of trichoscopy is clear: it is non-invasive, painless, rapid and available at the point of care. In contrast, direct microscopy requires adequate sampling and operator expertise, while culture may require several weeks. Nevertheless, a diagnostic adjunct should be judged not merely by how often a feature is seen in known disease, but by how well it distinguishes tinea capitis from patients without the disease. This distinction is central because several recent studies describe high “sensitivity” from confirmed-case cohorts that did not include a disease-negative comparison group. [2,4-10]

A 2020 systematic review summarised the broad trichoscopic literature, including many studies published before 2016. Since then, newer cohorts have examined paediatric populations in India and Somalia, species-pattern correlations in Brazil, and an adult-predominant Korean population. An updated review restricted to the most recent decade is therefore relevant, particularly when interpretation is anchored to mycological confirmation. [2,6-10]

2. REVIEW QUESTION AND OBJECTIVES

Review question: Among patients with suspected or clinically diagnosed tinea capitis, how useful is trichoscopy for identifying the disease and suggesting the causative dermatophyte when compared or correlated with KOH microscopy, fungal culture or PCR?

2.1 Primary objective

- To summarise the diagnostic accuracy of trichoscopy for tinea capitis when a mycological reference standard is available.

2.2 Secondary objectives

- To identify the trichoscopic signs most consistently reported in mycologically investigated cohorts.
- To evaluate whether specific signs distinguish Microsporum from Trichophyton infection.
- To assess methodological limitations that affect clinical interpretation and generalisability.

3. METHODS

3.1 Reporting approach

The manuscript was structured in accordance with the principles of PRISMA 2020. It is a systematic evidence-review draft rather than a registered protocol. A formal protocol was not prospectively registered, and no claim of PROSPERO registration is made. [1]

3.2 Eligibility criteria

Table 1. Prespecified eligibility criteria

Domain	Included	Excluded
Population	Human participants with suspected, clinically diagnosed or confirmed tinea capitis.	Animal studies; isolated non-scalp dermatophytosis without a separable tinea capitis subgroup.
Index test	Trichoscopy, scalp dermoscopy or dermatoscopy reporting hair-shaft, follicular or scalp signs.	Studies without trichoscopic assessment; ultraviolet fluorescence studies without separable conventional trichoscopy data.
Reference standard	KOH microscopy, fungal culture and/or PCR incorporated into the diagnostic pathway.	Purely clinical diagnosis with no mycological testing.
Outcomes	Diagnostic accuracy; frequency of trichoscopic signs; association with fungal species or invasion pattern.	Treatment response only, without baseline diagnostic or species-correlation data.
Design	Original prospective, cross-sectional or retrospective studies with at least 10 participants.	Case reports, very small case series, reviews, guidelines, editorials and conference abstracts without extractable results.
Publication window	1 January 2016 to 27 July 2026.	Published before 2016 or after the search date.

3.3 Information sources and search strategy

The search was updated on 27 July 2026. Sources included PubMed/MEDLINE-indexed records, PubMed Central full-text articles, journal publisher platforms and backward/forward citation checking from the 2020 systematic review and the 2026 Korean cohort. Searches combined controlled and free-text terms for tinea capitis with trichoscopy synonyms and mycological confirmation. No language restriction was applied at the search stage, but sufficient English-language information had to be available for reliable extraction. [2,10]

Core search concept: (“tinea capitis” OR “scalp ringworm”) AND (trichoscopy OR dermoscopy OR dermatoscopy OR videodermoscopy) AND (culture OR mycolog* OR KOH OR microscopy OR PCR).

The search was intentionally limited to publications from the preceding ten years. Related articles were checked for additional eligible studies. Search terms and a reproducibility checklist are provided in Appendix A.

3.4 Study selection and data extraction

Candidate reports were assessed against the eligibility criteria. Data were extracted on study design, country, sample size, participant age, mycological method, trichoscopy method, principal signs, diagnostic estimates and fungal-species associations. When a paper used the term “sensitivity” in a confirmed-case cohort without a disease-negative group, the result was retained exactly as reported but reclassified in the interpretation as case-detection sensitivity, because specificity and complete diagnostic accuracy could not be estimated.

3.5 Risk-of-bias assessment

Risk of bias was evaluated using diagnostic-accuracy domains adapted from QUADAS principles: participant selection, conduct and interpretation of the index test, reference standard, and participant flow/verification. No numerical quality score was used. Judgements were based only on information reported in accessible journal records.

3.6 Synthesis

A meta-analysis was not performed. The studies differed substantially in enrolment (suspected cases versus confirmed cases), clinical subtype, age distribution, dominant dermatophyte, trichoscope magnification, sign definitions and completeness of the reference standard. Most studies lacked disease-negative controls and could not provide 2 × 2 diagnostic data. Narrative synthesis was therefore considered more valid than pooling non-comparable percentages.

4. RESULTS

4.1 Study selection

Eight studies were retained for structured synthesis. Together, they included 640 enrolled or evaluated participants. Five studies used complete participant-level mycological confirmation or a culture-based disease-positive/disease-negative reference standard; three studies incorporated mycology but used partial or differential verification. A numeric PRISMA diagram is not presented because the database export, duplicate-removal and record-level screening files required to substantiate those counts were not available. Appendix B provides a transparent inclusion and exclusion log instead.

Interpretation of the evidence base
The strongest diagnostic-accuracy evidence comes from one prospective multicentre study that cultured all 100 participants. Most other studies describe how often signs occur in known or clinically selected tinea capitis and are better interpreted as pattern-recognition studies, not independent validations of diagnostic accuracy.

4.2 Characteristics of included studies

Table 2. Characteristics of studies included in the structured synthesis

Study	Setting/design	Participants	Mycological confirmation	Main purpose
Bourezane 2017 [3]	France; retrospective case series	24 culture-positive TC cases	Culture in all; 15 Trichophyton and 9 Microsporum	Describe signs and propose pathogen/invasion-pattern classification.
Dhaille 2019 [4]	France; prospective, four-centre diagnostic study	100 suspected TC; 53 culture-positive, 47 culture-negative	Culture in all participants	Estimate sensitivity, specificity, PPV and NPV for typical signs.
Kumar 2020 [5]	India; prospective observational	98 participants aged <18 years with TC	Positive KOH and/or culture required	Describe signs and propose a four-feature diagnostic combination.
Dalal 2022 [6]	India; cross-sectional	100 children with clinical TC	KOH and culture performed; KOH positive in 79%; participant-level confirmation incomplete	Clinicomycological profile and multi-feature case-detection sensitivity.
Ali 2024 [7]	Somalia; hospital-based cross-sectional	76 children aged <18 years	KOH and culture performed; KOH positive in 92.1%; some cultures negative/contaminated	Describe signs and associations with KOH positivity and species.
Meghwal 2024 [8]	India; cross-sectional observational	140 participants; predominantly children	KOH in all; culture in KOH-negative and selected willing participants; 137/140 confirmed by KOH or culture	Describe clinical subtype, signs and mycology; differential verification.
Azulay-Abulafia 2025 [9]	Brazil; retrospective cross-sectional	31 selected from 110 records	Included culture-positive M. canis or T. tonsurans cases	Assess whether signs suggest the causative genus/species.

Study	Setting/design	Participants	Mycological confirmation	Main purpose
Tran 2026 [10]	South Korea; retrospective single-centre	71 mycologically confirmed patients aged 2–90 years	Positive KOH and/or culture; PCR used for species identification	Correlate dermoscopy with subtype, age and fungal species.

4.3 Diagnostic accuracy

Dhaille et al. provided the only conventional diagnostic-accuracy analysis with a fully applied reference standard and a disease-negative comparator. Among 100 patients with presumed tinea capitis, culture was positive in 53 and negative in 47. Trichoscopy was considered positive when at least one typical feature was present. Sensitivity was 94% (95% CI 88–100), specificity 83% (95% CI 72–94), positive predictive value 92% and negative predictive value 86%. The typical feature set consisted of comma hairs, corkscrew hairs, zigzag hairs, Morse code-like hairs and whitish sheath. [4]

Kumar et al. reported that at least four features—short broken hairs, black dots, comma hairs and perifollicular scaling—were present in 97 of 98 mycologically positive participants, producing a reported sensitivity of 98.97%. Dalal et al. similarly reported 98.8% sensitivity for a five-feature combination that added erythema. These values demonstrate that multi-feature patterns were frequent among selected cases, but they are not equivalent to the diagnostic sensitivity of a blinded index test in an unselected suspected-disease population because neither study included disease-negative controls from whom specificity could be calculated. [5,6]

Table 3. Diagnostic estimates and appropriate interpretation

Study	Reported estimate	Design requirement met?	Interpretation
Dhaille 2019	Sensitivity 94%; specificity 83%; PPV 92%; NPV 86%.	Yes: suspected-disease cohort and culture in all.	Direct evidence that at least one typical sign has useful rule-in and screening value, although not perfect.
Kumar 2020	Reported sensitivity 98.97% for four-feature combination.	No disease-negative control group.	Within-case detection/coverage; specificity and real-world accuracy cannot be inferred.
Dalal 2022	Reported sensitivity 98.8% for five-feature combination.	No disease-negative control group; incomplete positive confirmation.	Within-case pattern frequency; likely overestimates performance in undifferentiated alopecia.

4.4 Common trichoscopic findings

Across cohorts, the most reproducible findings were dystrophic or fractured hairs accompanied by scalp scaling. Comma hairs were particularly frequent in several recent paediatric cohorts: 80% in Meghwal et al. and 93.1% in Ali et al. The Korean cohort, which was dominated by M. canis and included many adults, instead found scaling, black dots, follicular hyperkeratosis and broken hairs each in approximately four-fifths of patients; comma hairs were present in 59.2%. This variation indicates that sign frequency is influenced by organism distribution, clinical subtype, age, hair morphology and image interpretation. [7,8,10]

Table 4. Selected verified trichoscopic frequencies from recent cohorts

Study	Sample	Most frequent verified findings	Caution
Ali 2024 [7]	n=76 children	Comma hairs 93.1%; scales 40.8%; corkscrew hairs 32.9%.	Not every participant had a definitively positive culture; percentages are cohort frequencies.

Study	Sample	Most frequent verified findings	Caution
Meghwal 2024 [8]	n=140	Scaling 89.2%; comma hairs 80.0%; corkscrew hairs 68.6%; black dots 67.1%; bent hairs 54.2%; broken hairs 42.8%.	Culture was selectively performed, creating partial-verification bias.
Tran 2026 [10]	n=71 confirmed	Scaling 83.1%; black dots 78.9%; follicular hyperkeratosis 78.9%; broken hairs 78.9%; bent hairs 64.8%; comma hairs 59.2%.	Adult-predominant, M. canis-endemic setting; not directly generalisable to Trichophyton-dominant paediatric populations.

4.5 Can trichoscopy predict the causative dermatophyte?

The evidence suggests biologically plausible patterns, but not a universally reliable species rule. In the prospective French accuracy study, comma hairs were more frequent with Trichophyton, zigzag hairs were more frequent with Microsporum, and Morse code-like hairs were not observed in Trichophyton cases. The Brazilian study likewise found comma hairs absent in all six M. canis cases but present in 12 of 25 T. tonsurans cases, while Morse code-like or whitish-sheath findings were more frequent with M. canis. These studies support a broad curvilinear/endothrix versus rectilinear/ectothrix concept. [4,9]

The 2026 Korean study supplied the most detailed recent species-stratified data. Among 63 patients with identified pathogens, empty follicles were more common with Trichophyton than Microsporum (83.3% versus 29.4%, $p=0.001$). Zigzag hairs (58.5% versus 16.7%, $p=0.009$), Morse code-like hairs (66.7% versus 8.3%, $p<0.001$), bent hairs (74.5% versus 41.7%, $p=0.040$) and scaling (86.3% versus 58.3%, $p=0.041$) were more frequent with Microsporum. However, comma and corkscrew hairs were not significantly different between genera in that cohort. The authors therefore cautioned against treating individual signs as strictly species-specific. [10]

Clinical interpretation

Morse code-like, zigzag and bent hairs strengthen suspicion of ectothrix/Microsporum infection, while comma hairs or empty follicles may suggest endothrix/Trichophyton infection. These are probabilistic clues, not substitutes for culture or molecular identification. Local epidemiology substantially changes predictive value.

4.6 Risk of bias and applicability

Table 5. Adapted risk-of-bias assessment

Study	Selection	Index test	Reference standard	Flow/verification	Overall concern
Bourezane 2017	High: confirmed-case series	Some: interpretation/blinding unclear	Low: culture-positive cases	Low	High for accuracy; useful for morphology
Dhaille 2019	Low: prospective suspected cases	Some: operator experience and blinding details limited	Low: culture in all	Low	Lowest concern in review
Kumar 2020	High: confirmed cases only	High: criteria developed within same cohort	Low	Low	High for diagnostic accuracy
Dalal 2022	High: clinical cases only	High: post hoc combination	Some	High: incomplete confirmation	High
Ali 2024	Some: hospital-selected children	Some	Some	Some: negative/contaminated cultures	Moderate-high

Study	Selection	Index test	Reference standard	Flow/verification	Overall concern
Meghwal 2024	Some: tertiary-centre sample	Some	Some	High: differential culture verification	High
Azulay-Abulafia 2025	High: 31 selected from 110 records	Some	Low: positive cultures selected	High: selective inclusion	High for prevalence/accuracy; moderate for species association
Tran 2026	Some: retrospective single centre	Low: two blinded reviewers	Low: KOH/culture; PCR for species	Some: incomplete species ID in 8	Moderate

The dominant bias was spectrum and selection bias. Most studies began with clinically diagnosed or mycologically positive cases, making characteristic signs appear more sensitive than they might be among patients with a broad range of scalp disorders. Differential verification was another concern because culture was not applied to every participant in several cohorts. Blinded interpretation of trichoscopic images was explicitly reported in the Korean study but was unclear in many earlier reports.

5. DISCUSSION

5.1 Principal findings

The current decade of evidence supports trichoscopy as a valuable bedside adjunct for tinea capitis. The most defensible quantitative estimate comes from Dhaille et al., in whom a single typical sign achieved high sensitivity and moderately high specificity against fungal culture. This result suggests that the absence of all typical signs reduces the probability of tinea capitis, while the presence of a characteristic hair-shaft abnormality meaningfully increases diagnostic confidence. Nevertheless, neither sensitivity nor specificity was perfect, so mycological confirmation remains necessary when the diagnosis is uncertain, the presentation is inflammatory or atypical, or species identification may affect treatment choice. [4]

The evidence also shows why combinations of signs are clinically preferable to isolated findings. Scaling, black dots and broken hairs are common but overlap with other causes of alopecia. A pattern combining scaling with comma, corkscrew, zigzag or Morse code-like hairs is more persuasive. This pattern-based approach is consistent with the 2020 systematic review and with the latest Korean data, which emphasise coexistence and clinical context rather than a single pathognomonic marker. [2,10]

5.2 Why the reported “99% sensitivity” requires caution

Two studies reported approximately 99% sensitivity for multi-feature criteria. Because those criteria were derived and tested within cohorts already selected as tinea capitis, they answer the question “how often is this pattern present in cases?” rather than “how accurately does this pattern distinguish cases from non-cases?” This design inflates apparent diagnostic performance and cannot establish specificity, likelihood ratios or predictive values. These results are clinically useful for feature recognition but should not be presented as externally validated diagnostic tests. [5,6]

5.3 Species prediction

Species prediction could be useful because the relative efficacy of systemic antifungals may differ between Microsporum and Trichophyton infections. However, the reviewed studies do not justify selecting therapy solely from trichoscopy. The strongest repeated signal is that Morse code-like, zigzag and bent hairs occur more often with ectothrix/Microsporum infection. Yet comma and corkscrew hairs are not exclusive to Trichophyton, and severe shaft damage can produce overlapping appearances. The predictive value of each sign will also change with local pathogen prevalence. [4,9,10]

5.4 Implications for practice

- Use trichoscopy immediately in patients with patchy alopecia, scaling, black dots or suspected kerion to identify characteristic dystrophic hairs and guide sampling.
- Sample the most abnormal hairs or the active border for KOH microscopy and culture; trichoscopy may improve sample targeting.
- Treat a combination of perifollicular/diffuse scaling and fungal-type dystrophic hairs as strong evidence, but retain the differential diagnosis when only nonspecific black dots or broken hairs are present.
- Use species-associated patterns only as provisional clues while awaiting culture or PCR, particularly in regions where local dermatophyte prevalence is known.
- Do not use trichoscopy alone to declare mycological cure or to exclude infection in a highly inflamed kerion, because inflammatory changes and crusting may obscure shaft signs.

6. LIMITATIONS OF THIS REVIEW

- The search was structured but did not include direct subscription-database exports from Embase, Scopus or Web of Science. A submission-grade update should repeat the search in those databases and retain full search histories and de-duplication files.
- Several potentially relevant brief reports or paywalled articles did not provide enough accessible participant-level detail for reliable extraction and were therefore recorded in the selection log rather than used to generate unsupported numbers.
- The evidence base is dominated by single-centre, clinically selected and paediatric cohorts. Only one study provided a complete disease-positive/disease-negative diagnostic-accuracy design.
- Definitions of individual signs, dermoscope magnification, polarisation, hair type, clinical subtype and dominant dermatophytes varied substantially.
- No meta-analysis was performed because pooling heterogeneous case frequencies with true diagnostic-accuracy estimates would be methodologically misleading.

7. CONCLUSION

Trichoscopy has meaningful diagnostic utility in tinea capitis as a rapid, non-invasive adjunct to clinical examination and mycological testing. A typical dystrophic-hair sign has demonstrated high sensitivity and moderately high specificity in one prospective multicentre culture-controlled study. Across recent mycologically investigated cohorts, comma hairs, black dots, broken hairs and scaling are common, while Morse code-like, zigzag and bent hairs provide useful—though not definitive—clues toward Microsporum infection. The current evidence supports trichoscopy for early recognition, differential diagnosis and targeted sampling, but not as a replacement for KOH microscopy, fungal culture or PCR. Future studies should enrol consecutive patients with undifferentiated scalp disease, apply the same reference standard to all participants, blind trichoscopy readers and report complete 2 × 2 data for prespecified diagnostic algorithms.

8. EVIDENCE SUMMARY FOR READERS

Table 6. Bottom-line evidence statements

Question	Best supported answer	Confidence
Does trichoscopy help diagnose tinea capitis?	Yes. One culture-controlled multicentre study found 94% sensitivity and 83% specificity for at least one typical sign.	Moderate
Is a single sign sufficient?	A typical sign increases probability, but combinations of scaling and dystrophic hairs are more clinically persuasive.	Moderate
Can trichoscopy replace KOH/culture?	No. False-positive and false-negative findings remain possible, and species confirmation is important.	High
Can it predict Microsporum versus Trichophyton?	It can provide provisional clues; Morse code-like/zigzag/bent hairs favour Microsporum, while comma hair or empty follicles may favour Trichophyton in some settings.	Low-moderate
Can the reported ~99% "sensitivities" be taken at face value?	Not as external diagnostic accuracy, because they were derived from case-only cohorts without negative controls.	High

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