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DIAGNOSTIC VALUE OF TRICHOSCOPY IN THE DIFFERENTIAL DIAGNOSIS OF VARIOUS FORMS OF ALOPECIA

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Abstract. Alopecias of various origins present a significant diagnostic challenge in dermatological practice. Trichoscopy, a non-invasive method for visualizing the scalp, has become a key tool in recent years for the early and accurate diagnosis of hair loss.

Objective. To determine the modern capabilities of trichoscopy in the differential diagnosis of various forms of alopecia and to assess its diagnostic value.

Materials and Methods. An analytical review of 28 publications from 2019–2025 was conducted, including original studies and meta-analyses on trichoscopic diagnostic criteria in alopecias. Key morphological features, their sensitivity and specificity, as well as the role of the method in monitoring treatment effectiveness were analyzed.

Results. It was established that in androgenetic alopecia the most informative features are hair shaft diameter variability and the perifollicular halo; in alopecia areata - yellow and black dots, “exclamation mark” hairs; in scarring forms - absence of follicular openings and vascular changes. According to systematic reviews, the average diagnostic accuracy of trichoscopy is 90–95%. New digital technologies and artificial intelligence enhance the objectivity and reproducibility of interpretation.

Conclusions. Trichoscopy is an essential component in the diagnosis of alopecias, allowing differentiation of their forms, determination of disease activity, and assessment of treatment effectiveness. Standardization of terminology and the development of digital platforms will create new opportunities for integrating the method into clinical practice.

Keywords: trichoscopy, alopecia, differential diagnosis, dermoscopy, hair loss, scarring alopecia, androgenetic alopecia.

Алопецияның әртүрлі түрлерін ажыратуда трихоскопияның диагностикалық құндылығы

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Аңдатпа. Әртүрлі этиологиялы алопециялар дерматологиялық тәжірибеде елеулі диагностикалық қиындық тудырады. Трихоскопия – шаш пен бас терісін бейнелейтін инвазивті емес дерматоскопиялық әдіс, ол көзге көрінбейтін морфологиялық және тамырлық өзгерістерді анықтауға мүмкіндік беретін заманауи диагностикалық құралға айналды.

Мақсат. Алопеция түрлерін ажыратуда трихоскопияның диагностикалық мүмкіндіктерін бағалау және оның дәлдігі мен клиникалық маңыздылығы туралы қазіргі деректерді жүйелеу.

Материалдар мен әдістер. 2019-2025 жылдар аралығындағы 28 ғылыми жарияланымға аналитикалық шолу жүргізілді. Оларға трихоскопиялық белгілердің диагностикалық маңыздылығын, сезімталдық пен ерекшелік деңгейін және трихоскопияның ауру барысын бақылаудағы рөлін талдаған түпнұсқа зерттеулер, жүйелі шолулар мен метаанализдер кірді.

Нәтижелер. Андрогенетикалық алопеция кезінде ең ақпаратты белгілер – шаш өзегінің диаметрінің өзгергіштігі мен перифолликулярлық ореол; ошақты алопецияда – сары және қара нүктелер, «леп белгісі» тәрізді және сынған шаштар; ал рубцылы түрлерде – фолликулярлы тесіктердің жоғалуы, перифолликулярлы эритема және атрофиялық ақ ошақтар анықталды. Трихоскопияның орташа диагностикалық дәлдігі гистологиялық тексеріспен салыстырғанда 90-95% құрады. Заманауи зерттеулерде цифрлық трихоскопия мен жасанды интеллект технологиялары трихоскопиялық бейнелерді автоматты тану мен сандық бағалаудың жаңа мүмкіндіктерін ашатыны көрсетілген.

Қорытынды. Трихоскопия алопецияның кез келген түрін анықтауда алғашқы диагностикалық әдіс ретінде қарастырылуы тиіс.Бұл әдіс ауру түрлерін ерте және дәл ажыратуға, қабыну белсенділігін бағалауға және емнің тиімділігін бақылауға мүмкіндік береді. Терминологияны стандарттау және цифрлық платформаларды дамыту трихоскопияны клиникалық тәжірибеге кеңінен енгізуге жол ашады.

Түйін сөздер: трихоскопия, алопеция, дифференциалды диагностика, дерматоскопия, шаштың түсуі, рубцылы алопеция, андрогенетикалық алопеция.

Диагностическая ценность трихоскопии в дифференциальной диагностике различных форм алопеции

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Аннотация. Алопеции различного генеза представляют серьёзную диагностическую проблему в дерматологической практике. Трихоскопия, как неинвазивный метод визуализации волосистой части головы, в последние годы стала ключевым инструментом для ранней и точной диагностики выпадения волос.

Цель. Определить современные возможности трихоскопии в дифференциальной диагностике различных форм алопеций и оценить её диагностическую ценность.

Материалы и методы. Проведён аналитический обзор 28 публикаций 2019-2025 гг., включающих оригинальные исследования и метаанализы по диагностическим критериям трихоскопии при алопециях. Рассмотрены ключевые морфологические признаки, их чувствительность и специфичность, а также роль метода в контроле эффективности терапии.

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Результаты. Установлено, что при андрогенетической алопеции наиболее информативны вариабельность диаметра волос и перипиларный ореол; при очаговой – жёлтые и чёрные точки, «восклицательные волосы»; при рубцовых формах – отсутствие фолликулярных устьев и сосудистые изменения. Средняя диагностическая точность трихоскопии по данным систематических обзоров составляет 90-95%. Новые цифровые технологии и искусственный интеллект повышают объективность и воспроизводимость интерпретации.

Выводы. Трихоскопия является обязательным компонентом диагностики алопеций, позволяя дифференцировать их формы, определить активность процесса и оценить эффективность лечения. Стандартизация терминологии и развитие цифровых платформ откроют новые перспективы для внедрения метода в клиническую практику.

Ключевые слова: трихоскопия, алопеция, дифференциальная диагностика, дерматоскопия, выпадение волос, рубцовая алопеция, андрогенетическая алопеция

Introduction

Trichoscopy is a non-invasive method of visualizing the scalp that allows for detailed assessment of hair follicle structure, hair shafts, and perifollicular tissues. In recent years, this method has become an integral part of diagnosing hair disorders, enabling early detection of pathological changes and increasing the accuracy of differential diagnosis of various forms of alopecia [1]. Modern studies show that trichoscopy makes it possible to determine the nature of the lesion and differentiate androgenetic, alopecia areata, scarring, telogen, and traction alopecia based on characteristic visual features. For alopecia areata, the typical findings include so-called “yellow dots,” “black dots,” “exclamation mark hairs,” short vellus hairs, and broken hairs [2]. These signs reflect active follicular destruction and temporary involution.

In androgenetic alopecia, pronounced hair-shaft diameter variability, an increased proportion of thin vellus hairs, and the presence of a perifollicular halo predominate, indicating follicular miniaturization under the influence of androgens [3]. Scarring forms of alopecia are characterized by the disappearance of follicular openings, atrophy and sclerosis of perifollicular tissues, as well as typical vascular changes [4]. These features allow scarring processes to be distinguished from reversible forms of hair loss at an early stage and enable timely adjustment of therapy. Trichoscopy plays a particularly important role in dynamic monitoring and evaluation of treatment effectiveness. Sequential photography of the same areas allows clinicians to track the appearance of new terminal hairs, a reduction in the number of “black dots,” and decreased hair fragility, making trichoscopy an objective monitoring tool [5]. Nevertheless, recent reviews show that the interpretation of trichoscopic findings requires high expertise and uniform terminology. The lack of standardized diagnostic criteria and grading scales often leads to variability in results. Therefore, current research focuses on developing unified algorithms and digital image-analysis systems to ensure comparability of data between clinics and improve diagnostic reliability [6]. Thus, trichoscopy occupies a key place in modern alopecia diagnostics, combining high informativeness, safety, and accessibility. Its use not only increases diagnostic accuracy but also helps determine optimal treatment strategies, which is especially important given the rising prevalence of hair disorders in the population.

The objective of this work is to systematize the trichoscopic patterns of the most common forms of alopecia, assess their sensitivity and specificity for differential diagnosis, and propose a practical

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algorithm for using trichoscopy in outpatient and specialized settings based on current publications from 2023–2025.

Materials and Methods

This study is an analytical review of modern publications devoted to the use of trichoscopy in the diagnosis of various forms of alopecia. A literature search was conducted in the PubMed, Scopus, and Web of Science databases for the period 2019–2025 using the following keywords: trichoscopy, alopecia, hair loss, dermoscopy, diagnosis, androgenetic alopecia, alopecia areata, scarring alopecia, telogen effluvium. Additional publications from open sources (Google Scholar, ResearchGate) and reports of international dermatological societies (EADV, ISHRS, ILDS) were also considered.

The inclusion criteria were:

- original studies, meta-analyses, or systematic reviews focused on the diagnostic capabilities of trichoscopy in alopecia;
- specification of concrete trichoscopic features and their diagnostic value (sensitivity, specificity, predictive value);
- publications in English or Russian with access to the full text.

The exclusion criteria were:

- single clinical case reports without quantitative data;
- studies concerning trichoscopy in infectious and inflammatory skin diseases without alopecia (e.g., seborrheic dermatitis or psoriasis).

A total of 42 publications were analyzed, of which 28 met the inclusion criteria and were used for the systematization of trichoscopic patterns. The analysis included studies on androgenetic, alopecia areata, scarring, telogen, traction, and infectious alopecia (tinea capitis).

To structure the data, a comparative analysis approach was used, including:

- classification of trichoscopic features into morphological groups (follicular, interfollicular, vascular);
- comparison of the frequency of identified features across different types of alopecia;
- assessment of their diagnostic specificity according to original studies and reviews (Rakowska et al., 2024; Rudnicka et al., 2025; Pirmez et al., 2023) [1–8].

Results and Discussion

Analysis of the selected publications (n = 28) showed that trichoscopy has high diagnostic value for all major forms of alopecia, including androgenetic, alopecia areata, telogen, scarring, infectious, and traction alopecia. The combination of trichoscopic features allows, in most cases, reliable differentiation of the etiology and activity of the process without the need for biopsy, which has been confirmed in the works of Rakowska et al. (2024), Rudnicka et al. (2025), and Pirmez et al. (2023) [1–8].

The summarized data are presented in a table (Table 1), reflecting key diagnostic features and their clinical significance. The methodological approach was based on the principles of evidence-based medicine, prioritizing studies with levels of evidence A–B according to the Oxford Centre for Evidence-Based Medicine classification (2020) [9–15].

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Table 1 – Trichoscopic Patterns in Different Forms of Alopecia and Their Differential Significance
Differential Diagnostic Significance

Type of Alopecia	Key Trichoscopic Features	Differential Criteria	Clinical Significance
Androgenetic Alopecia (AGA)	Variable hair shaft diameter (>20%), increased proportion of vellus hairs, yellow dots, peripilar halo, single empty follicles	Differs from TE by preserved follicular openings and gradual thinning	Main diagnostic method; assesses stage and treatment effectiveness
Alopecia Areata (AA)	Yellow dots, black dots, exclamation-mark hairs, broken hairs, short vellus hairs	Differs from TTM by absence of uneven hair lengths and hemorrhages	Early non-invasive marker of disease activity
Telogen Effluvium (TE)	Even thinning without yellow dots, normal hair diameter, no empty follicles, preserved skin pattern	Differs from AGA by absence of hair diameter variability and peripilar halo	Helps avoid overdiagnosis of AGA
Trichotillomania (TTM)	Hairs of different lengths, stubble hairs, broken hairs, hemorrhagic spots, empty follicles, V-shaped hairs	Differs from AA by absence of yellow dots and presence of trauma signs	Confirms psychogenic nature of hair loss
Scarring Alopecia (LPP, DLE, FFA)	Absence of follicular openings, white patches, perifollicular erythema, vascular loops, bluish background	Differs from non-scarring forms by loss of follicles	Allows early diagnosis and prevention of irreversible hair loss
Tinea capitis	Comma-shaped hairs, black dots, short broken hairs, gray-white scales, inflammatory pustules	Differs from AA by presence of scaling and infection signs	Requires mycological confirmation (PCR/culture)
Traction Alopecia	Hairs of different lengths, tulip hairs, empty follicles, no inflammation	Differs from AGA by absence of perifollicular halo and localization along hairline	Confirms mechanical nature of damage

The table systematizes trichoscopic features with the highest diagnostic value during visual examination of the scalp. In clinical practice, the combination of 2–3 characteristic features allows reliable differentiation of the most common forms of alopecia and minimizes the need for biopsy. Modern studies (Miteva et al., 2023; Rakowska et al., 2024; Rudnicka et al., 2025) confirm the high

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sensitivity of trichoscopy—up to 92% for androgenetic alopecia and 95% for alopecia areata—when standardized evaluation criteria are followed.

Androgenetic Alopecia (AGA).

The most characteristic features of androgenetic alopecia include variability of hair shaft diameter greater than 20%, an increased proportion of vellus hairs, and the presence of the peripilar sign (a thin hyperpigmented halo around the follicular opening). These changes reflect follicular miniaturization and perifollicular microinflammation. Additional markers include isolated empty follicles and yellow dots, which appear with long-standing disease. Modern research shows that in AGA, the sensitivity of trichoscopy reaches 92% and specificity—88% compared to histological verification. The method also allows objective evaluation of therapeutic response to antiandrogens or minoxidil through measurable changes in terminal hair density and diameter.

Alopecia Areata (AA).

For alopecia areata, a combination of five most informative signs has been described: yellow dots, black dots, exclamation-mark hairs, broken hairs, and short vellus hairs. These patterns indicate active hair destruction and its premature transition to the telogen phase. In the active stage, black dots and exclamation-mark hairs predominate, while in remission, vellus and short terminal hairs are more common. The presence of these features collectively allows highly accurate differentiation of alopecia areata from telogen effluvium and trichotillomania, where the structure and color patterns of broken hairs differ.

Telogen Effluvium (TE).

Telogen effluvium is characterized by uniform hair thinning without signs of inflammation and without significant variability in hair diameter. Follicular openings remain preserved, which distinguishes TE from AGA and scarring alopecias. Recent studies emphasize the value of combining trichoscopy with phototrichogram, which enables objective assessment of the proportion of telogen hairs and determination of the process's reversibility.

Scarring Alopecias (LPP, DLE, FFA).

The most challenging task remains the early diagnosis of scarring alopecias. Trichoscopic features typical of these forms include the absence of follicular openings, whitish atrophic patches, perifollicular erythema, and telangiectasias. In fibrosing folliculitis and lichen planopilaris, perifollicular white scales, a "bluish-gray" background, and irregular vessels may be present. In discoid lupus erythematosus, large follicular keratotic plugs and diffuse pigmentation changes of the skin are characteristic. Such features indicate the need for early initiation of immunomodulatory therapy to prevent irreversible scarring.

Trichotillomania and Tinea Capitis.

In trichotillomania, hairs of different lengths, hemorrhagic dots, V-shaped broken hairs, and empty follicles are observed, which helps distinguish it from AA. For tinea capitis, "black dots," short broken hairs, and scaling are typical, requiring mycological confirmation (PCR or culture). Trichoscopy enables early suspicion of infectious etiology and timely referral for laboratory testing.

General Trends and Practical Importance.

All analyzed sources emphasize that trichoscopy combines simplicity, accessibility, and high informativeness, while also serving as a tool for telemedicine and dynamic treatment monitoring. In recent years, the field of digital trichoscopy has been rapidly developing, with artificial intelligence being used for automatic pattern recognition and quantitative assessment of hair density. Publications

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from 2023–2025 (e.g., by Miteva, Rudnicka, Rakowska) show that machine-learning algorithms can achieve diagnostic accuracy of up to 94%, making the method promising for diagnostic standardization.

From a clinical perspective, trichoscopy is becoming an essential component of the evaluation of any form of alopecia. It not only enables identification of the type of hair loss, but also determines disease stage, assesses inflammatory activity, and evaluates treatment response. Thus, trichoscopy is evolving from an auxiliary method into a key tool of evidence-based trichology, requiring further standardization of terminology and integration into dermatological practice guidelines.

Conclusions

At the modern stage of dermatology development, trichoscopy is a highly informative, non-invasive, and accessible method for the visual diagnosis of alopecia. The conducted analysis showed that the use of trichoscopy significantly increases the accuracy of differential diagnosis between androgenetic, alopecia areata, scarring, telogen, traction, and infectious alopecia, allowing unnecessary biopsies to be avoided and treatment to be initiated earlier.

The most diagnostically significant signs are: hair diameter variability and peripilar halo in androgenetic alopecia; yellow and black dots, and “exclamation mark hairs” in alopecia areata; absence of follicular openings, perifollicular erythema, and atrophic areas in scarring forms.

Trichoscopy has also proven effective in the dynamic monitoring of therapy and disease progression. The development of digital trichoscopy and the application of artificial intelligence algorithms open new possibilities for standardizing assessments and increasing diagnostic accuracy.

Thus, trichoscopy should be considered an essential component of the comprehensive examination of patients with hair loss, ensuring early detection of pathological processes, individualized therapy, and improved clinical outcomes.

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