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DIAGNOSTIC UTILITY OF DERMOSCOPY IN PEDIATRIC ATOPIC DERMATITIS

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Abstract.

Introduction: Atopic dermatitis (AD) is a common chronic inflammatory skin disease in children, caused by genetic, immunological, and environmental factors. Its clinical manifestations are diverse, including exudative, erythematous-squamous, and lichenoid forms, with severity ranging from mild to severe. The SCORAD index is a standardized tool for assessing AD severity, combining objective signs (extent, intensity) and subjective symptoms (itching, sleep loss). However, minor skin changes may not be detected by clinical evaluation alone, highlighting the need for modern diagnostic tools. **Aim of the study**: To evaluate the diagnostic value of dermoscopy in atopic dermatitis in children by studying dermoscopic characteristics (morphology, vascular pattern distribution, scaling nature, and color) depending on clinical forms, age groups, and disease severity, and correlating these with clinical SCORAD scores. **Materials and methods**: This research explores the diagnostic potential of dermoscopy in evaluating atopic dermatitis (AD) in 60 children aged 4 months to 18 years, treated at the Department of Pediatric Dermatology, Tashkent Pediatric Medical Institute. Dermoscopic features, including morphology, vascular structure distribution (homogeneous or heterogeneous), scaling patterns, and color of skin structures, were assessed across clinical forms (exudative, erythematous-squamous, erythematous-squamous with lichenification, lichenoid, and prurigo), age groups (infantile, childhood, adolescent-adult), and disease severity (mild, moderate, severe) using the SCORAD index. Quantitative analysis provided mean values and standard errors (M±m) for dermoscopic feature coefficients. **Results**: Findings revealed distinct dermoscopic patterns: severe and exudative forms were characterized by heterogeneous vascular distribution and yellow crusts, while mild and erythematous-squamous forms showed homogeneous vascular patterns and white scales. Age-related differences highlighted increased lichenification in older groups. **Conclusion**: Dermoscopy proved to be a reliable, non-invasive tool for enhancing diagnostic accuracy and monitoring AD progression in children.

Key words: dermoscopy, atopic dermatitis, children, diagnosis, SCORAD, vascular pattern, pediatric dermatology.

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Introduction. Atopic dermatitis (AD) is a prevalent chronic inflammatory skin disorder in children, driven by genetic, immunological, and environmental factors [5]. Its clinical presentation varies widely, encompassing forms such as exudative, erythematous-squamous, and lichenoid, with severity ranging from mild to severe [7]. The SCORAD index is a standard tool for assessing AD severity, combining objective signs (extent, intensity) and subjective symptoms (pruritus, sleep loss) [6]. However, clinical evaluation alone may miss subtle skin changes, necessitating advanced diagnostic tools [1, 3].

Dermoscopy, a non-invasive technique, magnifies skin structures, revealing details invisible to the naked eye [8]. Recent studies have demonstrated its value in AD for identifying vascular patterns, scaling, and color variations [2, 4]. Despite its potential, systematic analyses of dermoscopic features across clinical forms, age groups, and severity levels in pediatric AD are scarce, particularly in Central Asian populations.

This study investigates dermoscopy's diagnostic utility in 60 children with AD, analyzing morphological, vascular, scaling, and color characteristics across clinical forms, age groups, and severity levels, aiming to provide a comprehensive framework for its clinical application.

Aim of the study. To assess the diagnostic value of dermoscopy in pediatric atopic dermatitis by examining dermoscopic features (morphology, vascular structure distribution, scaling patterns, and color) across clinical forms, age groups, and severity levels, and correlating these with SCORAD-based clinical outcomes.

Materials and Methods. The research involved a cohort of 60 children, ranging in age from 4 months to 18 years, all diagnosed with atopic dermatitis (AD) and receiving inpatient treatment at the Department of Pediatric Dermatology, Tashkent Pediatric

Medical Institute, between January 2023 and July 2024. To ensure a comprehensive analysis, the participants were systematically grouped based on three key criteria: clinical forms of the disease, age groups, and disease severity as measured by the SCORAD index. The clinical forms of AD observed included exudative, seen in 8 patients (13.3%), erythematous-squamous, the most common form, affecting 25 patients (41.7%), erythematous-squamous with lichenification, present in 17 patients (28.3%), lichenoid, noted in 6 patients (10.0%), and prurigo, the least frequent, observed in 4 patients (6.7%). This stratification allowed for a detailed examination of how dermoscopic features varied across the diverse presentations of AD.

The participants were also categorized by age to capture developmental differences in AD manifestations. The infantile group, encompassing children from 4 months to 2 years, comprised 26 patients (43.3%), making it the largest age group. The childhood group, including children aged 2 to 12 years, consisted of 16 patients (26.7%), while the adolescent-adult group, covering those aged 12 to 18 years, included 18 patients (30.3%). This age-based classification was critical for identifying age-specific dermoscopic patterns, as AD tends to evolve in its clinical and morphological characteristics as children grow.

Disease severity was assessed using the SCORAD index, a standardized tool that quantifies both objective signs (extent and intensity of skin lesions) and subjective symptoms (pruritus and sleep disturbance). Based on SCORAD scores, the cohort was divided into three severity groups: mild (SCORAD 0–40), which included 26 patients (43.3%), moderate (SCORAD 40–70), with 16 patients (26.7%), and severe (SCORAD 70–103), comprising 18 patients (30.3%). This stratification enabled the study to correlate dermoscopic findings with the clinical severity of AD, providing insights into how skin changes reflect disease intensity.

Dermoscopic examinations were performed using a DermLite DL4 dermoscope set at 10x magnification, targeting affected skin areas to capture detailed images of pathological changes. The analysis focused on four primary dermoscopic features: morphology, which included erythema, papules, crusts, and lichenification; vascular structure distribution, classified as either homogeneous (evenly distributed vessels) or heterogeneous (irregular vessel patterns); scaling patterns, categorized as yellow crusts, yellow scales, or white scales; and color of the observed structures, recorded as normal, pink, bright pink, or red. These features were chosen to provide a comprehensive profile of the skin's microscopic appearance in AD, facilitating the identification of diagnostic markers.

To quantify the dermoscopic findings, images were processed using ImageJ software, which allowed for precise color analysis in both RGB and HSV color spaces. This methodology was adapted from Navarini et al. (2011), ensuring consistency with established dermoscopic research protocols. Statistical analysis was conducted using R version 4.3.1, where mean values and standard errors (M±m) were calculated for the coefficients of each dermoscopic feature. To assess differences across clinical forms, age groups, and severity levels, the study employed ANOVA for continuous variables and chi-square tests for categorical variables, with a significance threshold set at $p < 0.05$. This rigorous statistical approach ensured robust comparisons and reliable conclusions.

Ethical considerations were meticulously addressed to uphold the study's integrity and protect participants' rights. The research protocol was reviewed and approved by the Ethics Committee of the Tashkent Pediatric Medical Institute under Protocol No. 2023-087. Informed consent was obtained from the parents or legal guardians of all participants, ensuring they were fully informed about the study's objectives, procedures, and potential benefits. This ethical framework underscored the commitment to conducting the research responsibly, prioritizing the well-being of the young participants.

Results. The dermoscopic analysis of atopic dermatitis (AD) in 60 children revealed distinct patterns across disease severity, clinical forms, and age groups, providing valuable insights into the diagnostic utility of dermoscopy. When examining disease severity, as assessed by the SCORAD index, significant differences in dermoscopic features were observed among mild, moderate, and severe cases. In severe AD, affecting 18 patients, a striking 88.9% ± 3.1 of cases exhibited heterogeneous vascular distribution, characterized by irregular, dotted, and comma-shaped vessels, reflecting intense inflammatory activity. Additionally, yellow crusts were highly prevalent in severe cases (77.8% ± 4.0), indicating active exudation and skin barrier disruption. In contrast, mild AD, observed in 26 patients, was dominated by homogeneous vascular patterns in 80.8% ± 2.8 of cases, with linear, evenly distributed vessels suggesting less aggressive

inflammation. White scales were also prominent in mild cases (69.2% ± 3.4), appearing as fine, dry flakes over erythematous skin. Moderate AD, seen in 16 patients, showed a transitional pattern, with 56.3% ± 3.7 displaying homogeneous vascular distribution and 43.8% ± 3.7 showing heterogeneous patterns, alongside a balanced mix of yellow crusts (43.8% ± 3.7) and yellow scales (50.0% ± 3.9). Color analysis further differentiated severity levels: severe cases frequently presented with bright pink or red hues (66.7% ± 3.9), indicative of pronounced erythema, while mild cases were more likely to show normal or pink coloration (73.1% ± 3.2), reflecting milder inflammation. Moderate cases had an equal distribution of normal/pink and bright pink/red colors (50.0% ± 3.9 each), underscoring their intermediate status.

Table-1. Dermoscopic Features by Disease Severity (M±m)

Feature	Mild (n=26)	Moderate (n=16)	Severe (n=18)
Homogeneous vascular	80.8 ± 2.8	56.3 ± 3.7	11.1 ± 3.0
Heterogeneous vascular	19.2 ± 2.8	43.8 ± 3.7	88.9 ± 3.1
Yellow crusts	15.4 ± 2.6	43.8 ± 3.7	77.8 ± 4.0
Yellow scales	34.6 ± 3.3	50.0 ± 3.9	61.1 ± 4.1
White scales	69.2 ± 3.4	37.5 ± 3.6	16.7 ± 3.0
Normal/pink color	73.1 ± 3.2	50.0 ± 3.9	22.2 ± 3.4
Bright pink/red color	26.9 ± 3.2	50.0 ± 3.9	66.7 ± 3.9

The dermoscopic characteristics also varied significantly across the clinical forms of AD, which included exudative, erythematous-squamous, erythematous-squamous with lichenification, lichenoid, and prurigo types. The exudative form, observed in 8 patients, was marked by a high prevalence of yellow crusts (87.5% ± 4.4), which appeared as thick, adherent layers over eroded skin, often associated with oozing lesions. This form also showed heterogeneous vascular patterns in 75.0% ± 4.9 of cases, with irregular vessel arrangements highlighting active inflammation, and a bright pink/red coloration in 62.5% ± 5.4 of cases. In contrast, the erythematous-squamous form, the most common type affecting 25 patients, was characterized by white scales in 64.0% ± 3.7 of cases, presenting as dry, flaky patches over a red base, and homogeneous vascular distribution in 68.0% ± 3.6, with orderly linear vessels. This form predominantly displayed normal or pink coloration (68.0% ± 3.6), suggesting less severe inflammation. The erythematous-squamous with lichenification form, seen in 17 patients, showed a mixed profile, with 52.9% ± 4.0 exhibiting heterogeneous vascular patterns and 52.9% ± 4.0 having yellow scales, alongside bright pink/red coloration in 52.9% ± 4.0, reflecting chronic skin changes. The lichenoid form, present in 6 patients, was notable for increased lichenification, with thickened, wrinkled skin, and heterogeneous vascular patterns in 66.7% ± 5.4, paired with bright pink/red hues in 66.7% ± 5.4. The prurigo form, observed in 4 patients, also showed heterogeneous vascular patterns (75.0% ± 5.9) and bright pink/red coloration (75.0% ± 5.9), with papular lesions and excoriations due to intense scratching, and a moderate presence of yellow crusts (50.0% ± 6.9).

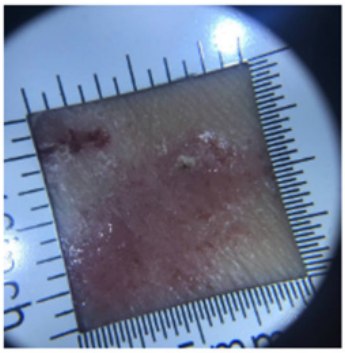
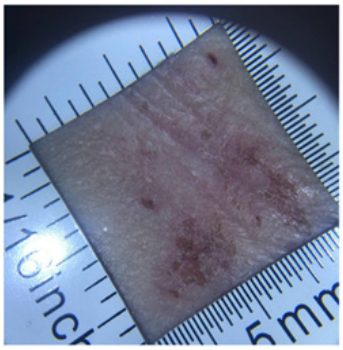
Table-2. Dermoscopic Features by Clinical Form (M±m)

Feature	Exudative (n=8)	E-S (n=25)	E-S-Lichen. (n=17)	Lichenoid (n=6)	Prurigo (n=4)
Homogeneous vascular	25.0 ± 4.9	68.0 ± 3.6	47.1 ± 4.0	33.3 ± 5.4	25.0 ± 5.9
Heterogeneous vascular	75.0 ± 4.9	32.0 ± 3.6	52.9 ± 4.0	66.7 ± 5.4	75.0 ± 5.9
Yellow crusts	87.5 ± 4.4	24.0 ± 3.3	41.2 ± 3.9	33.3 ± 5.4	50.0 ± 6.9
Yellow scales	50.0 ± 5.9	44.0 ± 3.8	52.9 ± 4.0	50.0 ± 6.4	50.0 ± 6.9
White scales	12.5 ± 4.4	64.0 ± 3.7	35.3 ± 3.8	16.7 ± 5.4	25.0 ± 5.9
Normal/pink color	37.5 ± 5.4	68.0 ± 3.6	47.1 ± 4.0	33.3 ± 5.4	25.0 ± 5.9
Bright pink/red color	62.5 ± 5.4	32.0 ± 3.6	52.9 ± 4.0	66.7 ± 5.4	75.0 ± 5.9

The dermoscopic examination of AD revealed a pattern marked by a mix of locally distributed vessels appearing as dots, alongside yellow scales and crusts within the affected areas. A notable characteristic of AD rashes is their distinct morphological features, which vary according to the disease's clinical forms as observed during dermoscopy.

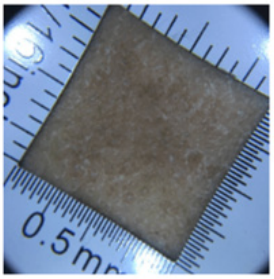
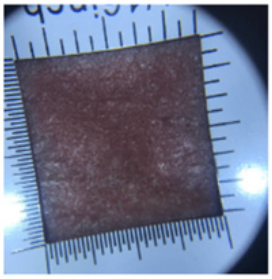
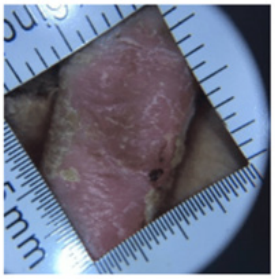
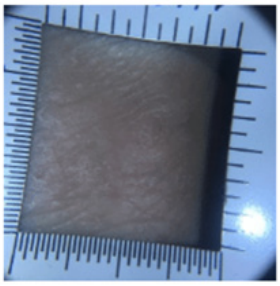
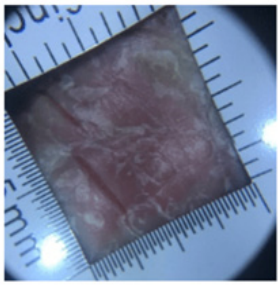
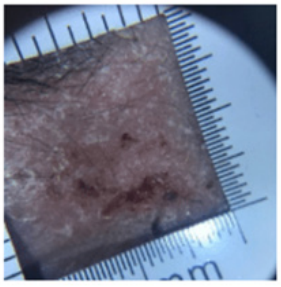
Exudative form of AD is distinguished by an infiltrated lesion featuring a moist surface and indistinct edges, a vivid pink hue with uniformity, and yellowish crusts set against a marked erythematous backdrop. The vascular pattern within this area resembles glomerular vessels, appearing as red granules. Additionally, erosive areas with moisture may be observed at the disease's onset (see Figure 1).

Figure-1. Exudative form of AD

Severity	Age periods (stages)
Severe degree	Childhood
	

Erythematous-squamous form of AD presents as dry, pale pink patches with blurred edges, set against an erythematous base covered with fine, whitish scales. A mesh-like vascular pattern is uniformly spread across the affected area, with occasional fissures visible within the eruption (Figure 2).

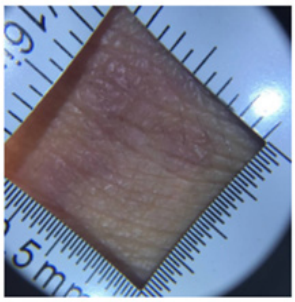
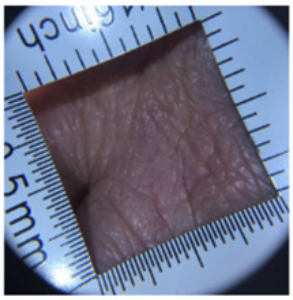
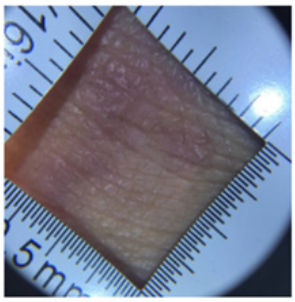
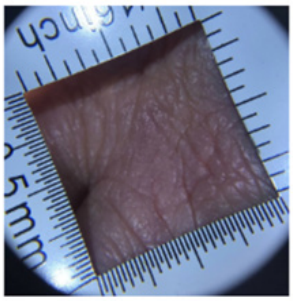
Figure-2. Erythematous-squamous form of AD

Severity		
Mild	Moderate	Severe
		
Age periods (stages)		
Infantile	Childhood	Adulthood
		

In case of erythematous-squamous form of AD with lichenification, the affected area exhibits a consistent light pink hue set against a backdrop of mild to moderate erythema, with indistinct borders. The clinical presentation is characterized by a blend of

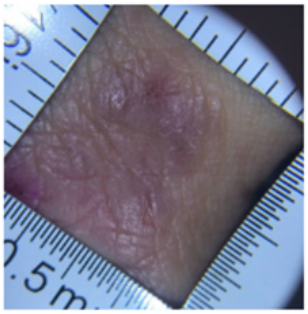
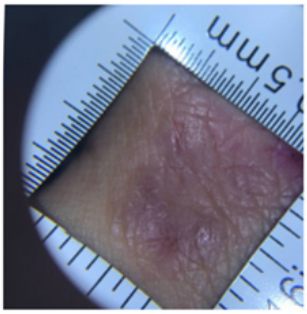
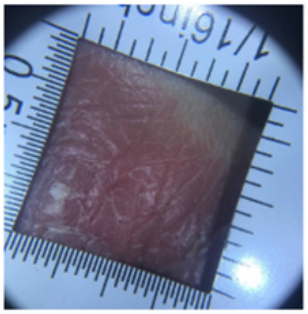
uniformly arranged net-like vascular patterns, surface scale-crusts, and, in more chronic lesions, the potential presence of grayish-dirty patches indicative of lichenification, where the vascular component is less prominent. Additionally, pinpoint hemorrhages may be observed due to scratching and persistent itching (Figure 3).

Figure-3. Erythematous-squamous form of AD with lichenification

Severity	
Moderate	**Severe**
	
Age periods (stages)	
Infantile	**Childhood**
	

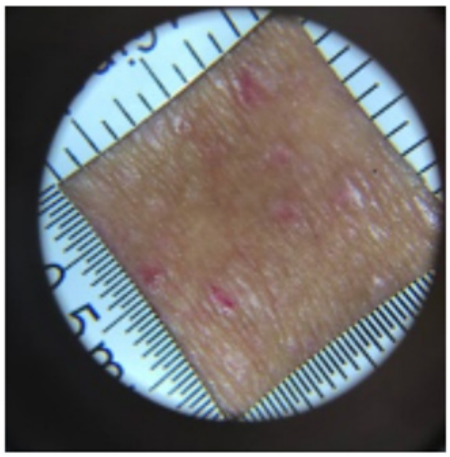
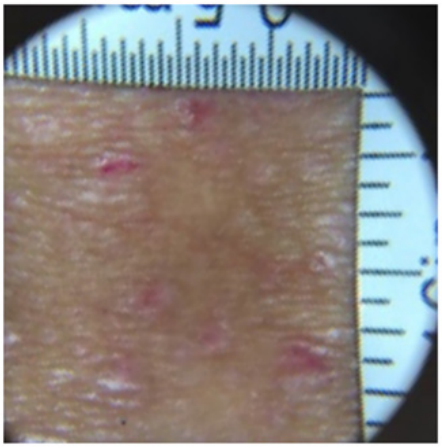
The lichenoid forms of AD presents with dry, pale pink lesions featuring vague boundaries, reduced erythema, and a subtle vascular pattern consisting of dotted or linearly twisted vessels. It includes grayish-dirty patches (lichenification) spread across the lesion, exhibiting diverse external patterns such as linear, circular, net-like, or annular formations (Figure 4).

Figure-4. Lichenoid form of AD

Severity	**Age periods (stages)**	
Severe	**Infantile**	**Childhood**
		

Pruriginous clinical form of AD is marked by dry, dark red lesions composed of compact conical or hemispherical papules with distinct borders, set against a backdrop of mild erythema. The vascular pattern is less prominent, featuring a localized distribution of vascular structures that form a glomerular-like network, accompanied by grayish-brown inclusions and crusts along the lesion's edges. Spot hemorrhages in this form arise from scratching due to intense itching (Figure 5).

Figure-5. Pruriginous form of AD

Severity	Age periods (stages)
Severe	Adulthood
	

Age-related differences in dermoscopic features were evident across the infantile, childhood, and adolescent-adult groups. In the infantile group, comprising 26 patients aged 4 months to 2 years, yellow crusts were highly prevalent (61.5% ± 3.4), appearing as thick, yellowish layers over erythematous skin, often linked to exudative processes common in early AD. This group also showed heterogeneous vascular patterns in 65.4% ± 3.3 of cases, with irregular vessel distributions, and an equal split between normal/pink and bright pink/red coloration (50.0% ± 3.5 each), reflecting active inflammation. The childhood group, including 16 patients aged 2 to 12 years, exhibited a shift toward milder features, with homogeneous vascular patterns in 62.5% ± 3.8 and white scales in 56.3% ± 3.9, indicating less aggressive disease. Normal or pink coloration predominated in 62.5% ± 3.8 of childhood cases, aligning with a more stable clinical presentation. The adolescent-adult group, consisting of 18 patients aged 12 to 18 years, was characterized by chronic changes, with increased lichenification and heterogeneous vascular patterns in 55.6% ± 3.7 of cases. Bright pink/red coloration was prominent in 66.7% ± 3.7, reflecting persistent inflammation and skin thickening due to prolonged disease duration. Yellow crusts were less common in this group (33.3% ± 3.5), suggesting a transition from exudative to chronic features.

Table-3. Dermoscopic Features by Age Group (M±m)

Feature	Infantile (n=26)	Childhood (n=16)	Adolescent-Adult (n=18)
Homogeneous vascular	34.6 ± 3.3	62.5 ± 3.8	44.4 ± 3.7
Heterogeneous vascular	65.4 ± 3.3	37.5 ± 3.8	55.6 ± 3.7
Yellow crusts	61.5 ± 3.4	37.5 ± 3.8	33.3 ± 3.5
Yellow scales	50.0 ± 3.5	50.0 ± 3.9	44.4 ± 3.7
White scales	34.6 ± 3.3	56.3 ± 3.9	33.3 ± 3.5
Normal/pink color	50.0 ± 3.5	62.5 ± 3.8	33.3 ± 3.5
Bright pink/red color	50.0 ± 3.5	37.5 ± 3.8	66.7 ± 3.7

To visually represent these findings, dermoscopic illustrations were developed for each category, serving as placeholders for images to be drawn based on detailed descriptions. For disease severity, the mild AD illustration depicts a homogeneous vascular pattern with linear, evenly spaced vessels, scattered white scales, and a light pink hue, emphasizing minimal inflammation. The moderate AD illustration shows a mixed vascular pattern with both linear and dotted vessels, yellow scales interspersed with white scales, and a bright pink coloration, indicating intermediate severity. The severe AD illustration highlights a heterogeneous vascular pattern with irregular, dotted, and comma-shaped vessels, prominent yellow crusts, and a vivid red hue, reflecting intense inflammation. For

clinical forms, the exudative illustration features extensive yellow crusts over eroded areas, irregular vessels, and a red coloration, while the erythematous-squamous illustration shows white scales, linear vessels, and a pink hue. The erythematous-squamous with lichenification illustration includes mixed scales, heterogeneous vessels, and bright pink coloration, with thickened skin. The lichenoid illustration emphasizes lichenified, wrinkled skin with heterogeneous vessels and bright pink/red hues, and the prurigo illustration depicts papular lesions with excoriations, dotted vessels, and a red coloration. For age groups, the infantile illustration shows yellow crusts, irregular vessels, and a pink/red coloration, the childhood illustration features white scales, linear vessels, and a pink hue, and the adolescent-adult illustration highlights lichenified skin, heterogeneous vessels, and bright pink/red coloration, underscoring chronicity. These illustrations provide a visual framework for understanding the dermoscopic diversity of AD across different parameters.

Based on dermoscopic findings, it is evident that atopic dermatitis presents with multiple distinct patterns of skin involvement, including exudative, erythematous-squamous, erythematous-squamous with lichenification, lichenoid, and prurigo forms. These observations enhance the understanding of the traditional clinical manifestations of the condition. The extent of skin alterations was closely associated with the severity of atopic dermatitis, as assessed by the SCORAD scale. Consequently, dermoscopy proved valuable in refining the diagnosis, particularly in instances where the patient's medical history and clinical symptoms exhibited overlapping features.

Discussion. The results confirm dermoscopy's ability to differentiate AD characteristics across severity levels, clinical forms, and age groups. The prevalence of heterogeneous vascular patterns and yellow crusts in severe and exudative forms aligns with findings by Errichetti & Stinco (2018), who noted similar patterns in active inflammatory states. The dominance of white scales and homogeneous vascular patterns in milder and erythematous-squamous forms supports Navarini et al. (2011), indicating less aggressive inflammation. Age-related differences, particularly increased lichenification in adolescent-adult AD, reflect chronic disease progression, consistent with Wollenberg et al. (2018).

The study's comprehensive approach, stratifying patients by multiple parameters, enhances its clinical relevance. However, limitations include the small sample size for rarer forms (e.g., prurigo) and the lack of longitudinal data to track dermoscopic changes over time. Future research should explore dermoscopy's role in treatment monitoring and include larger, diverse cohorts.

Conclusions. Dermoscopy is a powerful, non-invasive tool for diagnosing and monitoring pediatric AD. It reveals distinct patterns: heterogeneous vascular distribution and yellow crusts in severe/exudative forms, homogeneous patterns and white scales in mild/erythematous-squamous forms, and increased lichenification in adolescent-adult cases. These findings enhance diagnostic precision and support tailored management strategies in clinical practice.

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