Dermatology Practical & Conceptual

Assessing the Accuracy of Dermoscopy for Scabies Diagnosis in Dark African Skin

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ABSTRACT

Introduction: Scabies, a parasitic infestation caused by *Sarcoptes scabiei var hominis*, affects individuals of diverse skin types. While definitive diagnosis involves identifying adult mites, eggs, or scybala from the microscopy of scrapings obtained from representative sites, it is invasive, time-consuming, and not feasible in very young or non-cooperative patients. Dermoscopy is an evolving non-invasive procedure useful in dermatological diagnosis. The handheld dermatoscope is portable and valuable for epidemics and in vivo use. There are sparse data on the diagnostic accuracy of dermoscopy versus microscopy in darker skin phototypes, a demographic for which dermoscopy have been understudied.

Objective: This study aimed to compare the diagnostic accuracy of dermoscopy with microscopy in dark skin.

Methods: Consecutive patients attending the dermatology clinic at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria, with clinical suspicion of scabies underwent dermoscopic and microscopic examination. Definitive diagnosis was retrospective, and a comparative assessment between dermoscopy and microscopy was conducted.

Results: Dermoscopic and microscopic evidence was observed in 48.3% and 46.7%, respectively. While the serpiginous tract had a sensitivity and specificity of 75.9% and 80.6%, respectively, delta sign was 75% and 55.4%, respectively. Both dermoscopy and microscopy demonstrated a sensitivity and specificity of 75% and 55.4%, respectively. The delta glider sign was seen in four participants.

Conclusion: Dermoscopy is particularly effective in identifying the serpiginous tract of scabies on dark skin, although it is less effective for detecting the delta sign. Non-specific dermoscopic features may frequently be seen. Future studies should modify criteria for darker skin to enhance clinical accuracy.

Introduction

Scabies, caused by *Sarcoptes scabiei var hominis*, remains highly prevalent in developing countries, with reported prevalence rates reaching alarming levels [1-3]. Scabies is characterized by the tunneling of adult mites into the outer layer of the skin–the stratum corneum–resulting in the formation of burrows. These burrows are a classical sign of scabies infestation 4. Despite their diagnostic importance, they are often not visible to the naked eye due to being obscured by other skin conditions like scales, crusts, or eczema, which may accompany scabies [4].

There are several diagnostic tests for scabies, each with its advantages and limitations [4, 5]. While the gold standard for diagnosis involves the identification of adult mites, eggs, or fecal matter (scybala) from the microscopy of skin scrapings, offering diagnostic accuracy within an acceptable range, its limitations include extended turnaround times, lack of needed equipment, and dependence on technical and specialized skills [4-7]. Moreover, the invasive nature of scraping poses challenges, particularly in pediatric cases and with non-cooperative patients. Although the ink test can be used to highlight the burrows, it does not differentiate old from new lesions, giving a lot of false positives, and is therefore useful only as a screening tool [8].

In contrast, dermoscopy has emerged as a valuable diagnostic tool that utilizes magnification to visualize skin microstructures. It provides several benefits over traditional methods, including expedited diagnostic outcomes even in inexperienced hands and enhanced patient comfort due to its non-invasive nature [9, 10]. Existing data identify the "jet with contrail" sign, a combination of the delta glider sign, which is the anterior part of the mite, and the serpiginous tract, which is the burrow, a distinct dermoscopic feature of scabies among Caucasians [11, 12]. However, dermoscopy use in dark skin phototypes remains relatively underexplored [13]. Instead, diagnosis predominantly relies on the presence of serpiginous tracts (burrows) as a more common indicator [12]. This is thought to result from the blunting of this feature due to diffuse scaling caused by intense scratching or the pigmented background [12].

Despite its diagnostic utility, dermoscopy use is largely limited in Sub-Saharan Africa, where a significant proportion of individuals with dark skin reside [13]. The effectiveness of dermoscopy as a practical and readily available diagnostic instrument, along with its specific dermoscopic traits for scabies detection in individuals with darker skin tones, remains uncertain. This study aimed to assess the diagnostic precision of dermoscopy in contrast to conventional microscopy and to ascertain the prevalence of various dermoscopic features associated with scabies in darker skin phototypes.

The findings from this study have the potential to enhance diagnostic practices, leading to improved and timely management of scabies in this understudied population.

Objective

To compare the accuracy of dermoscopy with microscopy and evaluate the reliability of dermoscopic findings in darker skin phototypes.

Methods

A cross-sectional study involving consecutive individuals with skin types IV–VI presenting to the dermatology clinic at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria. Participants diagnosed with scabies based on a thorough clinical evaluation, inclusive of compatible clinical history and physical examination to exclude common differential diagnoses, along with a successful anti-scabies treatment were enrolled in this study.

Dermoscopic images of the affected skin were obtained using a Dermlite DL4 with pigment boost (3Gen, San Juan Capistrano, CA, USA) attached to an iPhone 6S under polarized mode at 10X magnification. Dermoscopic features were documented, then skin scraping using mineral oil preparation was performed for microscopy. Findings were analyzed for those considered to have a definitive diagnosis of scabies. In this case, a definitive diagnosis of scabies was considered as a complete resolution of manifestations/symptoms after specific therapy for scabies (ivermectin, in this case).

The dermoscopic examination was considered negative after all possible sites (Hebra) showed none of the classical or non-specific dermoscopic features.

Individuals with contraindications to the use of ivermectin or those previously treated with anti-scabies medications were excluded from the study. This exclusion criterion included children under the age of 5 years and pregnant or breastfeeding women.

Results

Dermographic Characteristics of Study Participants

A total of 60 patients were included in the analysis. All demographic characteristics of the study participants are highlighted in Table 1. Notably, all were Fitzpatrick skin types IV–VI.

Table 1. Age Distribution of Respondents.

		Frequency	Percentage
Sex	Male	28	46.7
	Female	32	53.3
Age range	<= 18	20	33.3
	19-45	28	46.7
	46-65	11	18.3
	>65	1	1.7
	Total	60	100
	Mean	28.2	
	STD	16.473	

Presence of Dermoscopic Evidence of Scabies

Fewer than half (48.3 %) had classical dermoscopic evidence of scabies comprising serpiginous tract and/or delta glider sign (Figure 1), while 51.7% did not show any of the known dermoscopic evidence of scabies. The non-classical features commonly seen included scales (56 .7%), erosions (41.7%), pustules (10%), crusts/scabs, and others (Figures 1 and 2).

Presence of Microscopic Evidence of Scabies

While 46.7% had microscopic evidence of scabies comprising the presence of adult mites, eggs, and scybala, 53.3% had no microscopic evidence of scabies. The eggs were the most visualized (46.7%), while the adult mite was the least visualized (6.7%).

Accuracy of Typical Dermoscopic Features in Diagnosis of Scabies

The accuracy of visualizing the characteristic delta sign and/or serpiginous tract compared to microscopic evidence is detailed in Table 2. These dermoscopy-specific features demonstrated a sensitivity of 75.9% and a specificity of 80.6% compared to microscopy.

Accuracy of Serpiginous Tract and Delta Sign in Diagnosis of Scabies

Table 3 highlights how effectively the serpiginous tract or delta sign correlated with microscopic findings in diagnosing scabies. The sensitivity and specificity of the serpiginous tract were 75.9% and 80.6%, respectively, and those of the delta

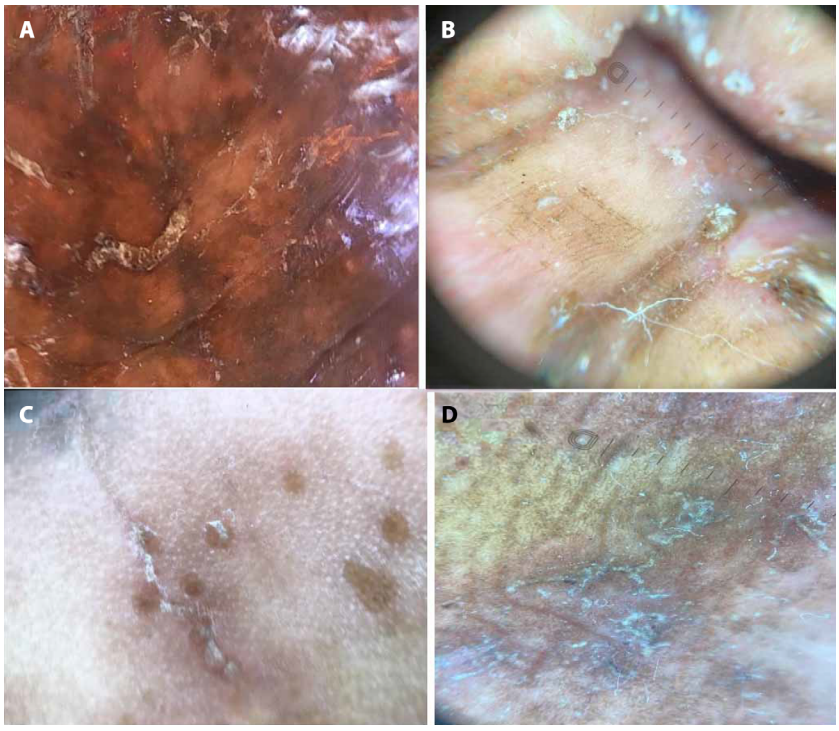

Figure 1. Serpiginous tracts in different patients. There are non-specific features like (A) brownish structureless areas, (B) crusts and pustules, (C) erosions and scales, and (D) scabs.

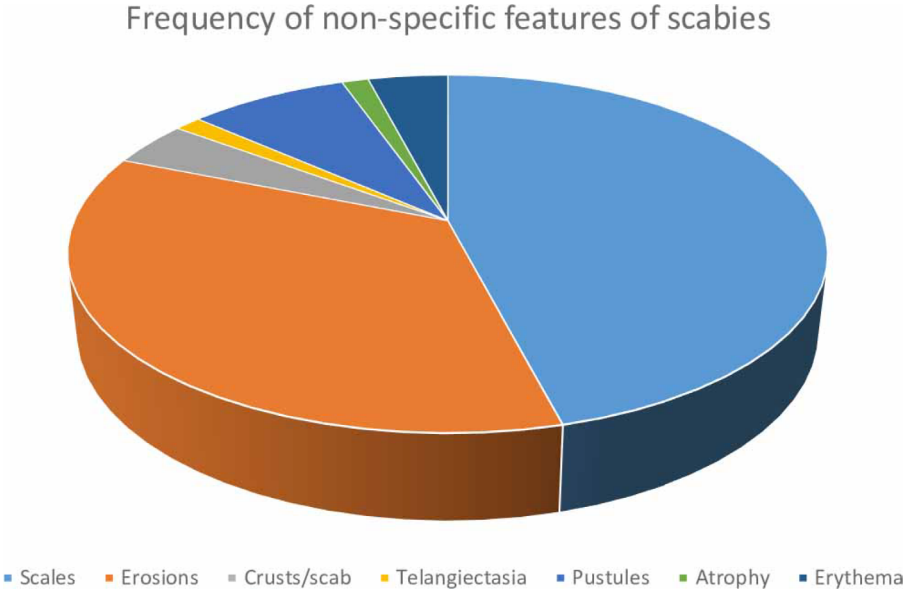

Figure 2. Proportion of non-specific dermoscopic features of scabies seen.

Table 2. Accuracy of Dermoscopic Diagnosis of Scabies.

		Microscopic Evidence of Scabies				
		Absent	Present	Total	X^2	P-Value
Dermoscopic evidence of scabies	Absent	25(80.6)^{SP}	6(19.4)	31(100)	19.223	<0.01
	Present	7(24.1)	22(75.9)^{SE}	29(100)		
	Total	32(53.3)	28(46.7)	60(100)		
3.59; 0.27						

LR^+ = 3.59; LR^- = 0.27. Abbreviations: X^2: chi-square value; LR^+: likelihood ratio of testing positive, LR: likelihood ratio of testing negative; SE: sensitivity; SP: specificity.

Table 3. Accuracy of Serpiginous Tract and Delta Sign in Diagnosis of Scabies.

		Microscopic Evidence of Scabies				
		Absent	Present	Total	X^2	P-Value
Serpiginous tract	Absent	25(80.6)^{SP}	6(19.4)	31(100)	19.223	<0.01
	Present	7(24.1)	22(75.9)^{SE}	29(100)		
	Total	32(53.3)	28(46.7)	60(100)		
"Delta sign"	Absent	31(55.4)^{SP}	25(44.6)	56(100)	1.382	0.24
	Present	1(25)	3(75)^{SE}	4(100)		
	Total	32(53.3)	28(46.7)	60(100)		
Both	Absent	31(55.4)^{SP}	25(44.6)	56(100)	1.382	0.24
	Present	1(25)	3(75)^{SE}	4(100)		
	Total	32(53.3)	28(46.7)	60(100)		

Abbreviations: X^2: Chi-square value; SE: sensitivity; SP: specificity.

sign were 75% and 55.4%, respectively. When combined, both dermoscopy and microscopy demonstrated a sensitivity of 75% and specificity of 55.4%. Notably, the delta glider sign was only seen in four participants.

The presence of the serpiginous tract was strongly correlated with microscopic evidence of scabies. The majority (75.9%) of the participants who had serpiginous tract showed positive microscopy, whereas 19.4% of those

without serpiginous tracts had microscopic evidence, (X^2 = 19.223, P <0.01). In contrast, the delta sign had a weaker correlation. Notably, four out of 60 participants (6.7%) showed the delta sign, with a sensitivity of 75% and specificity of 55.4% (X^2 = 1.382, P = 0.24). When both the serpiginous tract and delta sign were considered, the chi-square value remained 1.382, with a p-value of 0.24, indicating no significant improvement in diagnostic accuracy.

Relationship Between Classic Dermoscopic and Microscopic Evidence with Complete Resolution of Scabies Symptoms

In both groups, all cases showed complete resolution of symptoms. Specifically, all 29 patients with dermoscopic evidence (100%) and all 28 patients with microscopic evidence (100%) experienced symptom resolution. No case remained unresolved in either group.

Discussion

There are limited studies in the literature that explore the diagnostic accuracy of dermoscopy in the darker skin phototypes. This study was carried out on individuals with Fitzpatrick's skin types IV–VI. This focus is crucial, as skin type can influence the visibility of dermoscopic features, potentially impacting diagnostic accuracy. Darkly pigmented skin has an increased tendency of sclerotic reactions, pigment incontinence, and formation of scales, which can potentially affect visualization of characteristic dermoscopic features of scabies [12].

Dermoscopic Evidence of Scabies

Fewer than half of the participants (48.3%) exhibited typical dermoscopic evidence of scabies, characterized by serpiginous tracts and/or delta glider signs, while 51.7% did not display these classical signs. This prevalence is lower than previously reported in other racial groups [14, 15]. This may be due to various factors, including difficulties with visualizing the typical dermoscopic findings in the darker skin phototypes [12]. The delta glider sign, a specific dermoscopic sign in diagnosing scabies, is particularly challenging to visualize on dark skin due to pigmentary changes caused by prolonged itching. Furthermore, secondary changes such as scales, crusts, scabs, and erosions can obscure the serpiginous tract and this important diagnostic feature, complicating the identification process. In contrast, the frequency of the delta glider sign was higher than was seen in one study, where dermoscopic features were observed in 10.7% of participants. This discrepancy may be due to the ease of identifying these features in the population studies or the expertise of the dermoscopists involved [16].

Other non-classical features reported in other studies, such as peripherally located scales, erosions, and crusts and scabs, were significant findings in our participants. Notably, scales occurred in greater proportions than all the scabies-specific lesions. Excoriations and pustules had a higher proportion than the delta glider sign. Atypical scabies lesions or modifications of typical lesions due to secondary reactions, eczematization, or impetiginization may occur more commonly in darkly pigmented skin [12]. These key dermoscopic features can also be obscured by pigment incontinence and lichenification, which are common in dark skin, leading to a broader variety of possible diagnostic dermoscopic features [4, 17].

Microscopic Evidence of Scabies

Microscopic examination revealed scabies in 46.7% of participants and comparable to the results by Walter et al., with eggs being the most frequently observed (46.7%) and adult mites the least (6.7%) [22]. This was lower than the detection rate in several studies but higher than those found in one study and may reflect differences in techniques of sample collection [9, 14, 16].

Accuracy of Dermoscopic Diagnosis of Scabies

Dermoscopy showed a sensitivity of 75.9% and a specificity of 80.6%, demonstrating reliability in the detection of both the presence and absence of scabies in a significant number of cases. The chi-square value of 19.223 and a p-value of less than 0.01 established a statistically significant association between dermoscopic findings and microscopic evidence of scabies, underscoring the diagnostic reliability of the former. Furthermore, the positive likelihood ratio of 3.59 and a negative likelihood ratio of 0.27 for dermoscopy shows robust diagnostic accuracy, correctly identifying 78.3% of cases overall. Our study affirmed dermoscopy's comparable efficacy to that of microscopy in diagnosing scabies in dark-skinned individuals, aligning with prior research [9, 10, 14, 16, 17]. While previous studies have often favored dermoscopy over microscopy, our findings did not indicate superiority [16, 18, 19].

Serpiginous Tract and Delta Sign

The findings of a strong correlation of serpiginous tract and a weaker correlation of delta sign with microscopy suggest that while dermoscopy is a useful tool for diagnosing scabies, especially when the serpiginous tract is observed, the delta sign alone is less reliable. The high specificity and sensitivity of the serpiginous tract highlight its diagnostic value, making it a critical feature to identify during dermoscopic examinations. This agrees with previous observations in the literature on the challenges with visualizing the delta sign due to the

presence of pigmentation, lichenification, and other changes like scales and crusts in dark skin [4, 12, 17].

Dermoscopic vs. Microscopic Evidence

Our study's sensitivity of 75.9% is higher than Abdel-Latif et al.'s 43.5% but lower than Walter et al.'s 83.0% and Dupuy et al.'s 91.0%, indicating moderate effectiveness in identifying true positive scabies cases [9, 19, 20]. Our specificity of 80.6% is close to Abdel-Latif et al.'s 84.4% and Dupuy et al.'s 86.0%, and significantly higher than Walter et al.'s 46.0%, making our method more reliable in identifying true negative cases. Put together, our study suggests a balanced diagnostic accuracy with a reasonable trade-off between sensitivity and specificity. Thus, dermoscopy shows moderate-to-high performance, competitive with but not superior to the methods in other studies.

Resolution of Scabies Symptoms

Remarkably, all participants with either dermoscopic or microscopic evidence of scabies showed complete resolution of symptoms following treatment. This emphasizes the effectiveness of the treatments used and supports the reliability of both diagnostic methods in guiding successful therapeutic interventions.

Limitations

We did not evaluate the accuracy of dermoscopic features across the three phototypes within the skin of color spectrum.

Conclusion

Dermoscopy is a valuable diagnostic tool for scabies, particularly effective in identifying the serpiginous tract in darker skin phototypes (Fitzpatrick types IV–VI). It strongly correlates with microscopic evidence, making it a reliable non-invasive method. However, reliance on the delta sign alone is not recommended due to its lower diagnostic accuracy. Combining dermoscopy with microscopic examination can enhance diagnostic precision. Despite its usefulness, dermoscopy has its limitations, especially with the occurrence of non-classical features in dark skin, highlighting the need for microscopic confirmation in suspicious cases with negative dermoscopic features. Future studies should aim to improve dermoscopic criteria in dark skin and integrate compatible history and complementary diagnostic methods to increase accuracy, especially in dark skin phototypes.

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