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Braun, Ralph P ; Thomas, L ; Dusza, S W ; et al

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Dermoscopy of Acral Melanoma: A Multicenter Study on Behalf of the International Dermoscopy Society

Ralph P. Braun[a] L. Thomas[c] S.W. Dusza[e] O. Gaide[b] S. Menzies[i] S. Dalle[c] A. Blum[j] G. Argenziano[m] I. Zalaudek[m, s] A. Kopf[f] H. Rabinovitz[g] M. Oliviero[g] A. Perrinaud[d] H. Cabo[u] M. Pizzichetta[n] L. Pozo[v] D. Langford[w] M. Tanaka[x] T. Saida[y] A.M. Perusquia Ortiz[k] J. Kreusch[l] V. De Giorgi[o] D. Piccolo[p] J.M. Grichnik[h] H. Kittler[t] S. Puig[z] J. Malvehy[z] S. Seidenari[q] I. Stanganelli[r] L. French[a] A.A. Marghoob[e]

[a]Department of Dermatology, University Hospital Zürich, Zürich, and [b]Service de Dermatologie, CHUV, Lausanne, Switzerland; [c]Department of Dermatology, Lyon 1 University, Centre Hospitalier Lyon-Sud, Lyon, and [d]Service de Dermatologie, CHU Trousseau, Tours, France; [e]Dermatology Service, Memorial Sloan Kettering Cancer Center, and [f]Department of Dermatology, New York University of Medicine, New York, N.Y., [g]Skin and Cancer Associates, Plantation, Fla., and Sylvester Comprehensive Cancer Center/UMHC Melanoma Clinic, University of Miami Hospital and Clinics, Miami, Fla., and [h]Anna Fund Melanoma Program, Department of Dermatology, Miller School of Medicine, University of Miami, Miami, Fla., USA; [i]Sydney Melanoma Diagnostic Centre, Sydney Cancer Centre, Royal Prince Alfred Hospital, Camperdown, N.S.W., and Discipline of Dermatology, Sydney Medical School, University of Sydney, Sydney, N.S.W., Australia; [j]Public, Private and Teaching Practice of Dermatology, Konstanz, [k]Dermatology Department, University of Münster, Münster, and [l]Skin Cancer Diagnostic Center, Lübeck, Germany; [m]Skin Cancer Unit, Arcispedale Santa Maria Nuova IRCCS, Reggio Emilia, [n]Division of Medical Oncology-Preventive Oncology, Centro di Riferimento Oncologico, National Cancer Institute, Aviano, [o]Department of Dermatology, University of Florence, Florence, [p]Department of Dermatology, University of L'Aquila, L'Aquila, [q]Department of Surgical, Medical, Odontoiatric and Morphological Sciences, University of Modena and Reggio Emilia, Modena, and [r]Skin Cancer Unit, Istituto Tumori Romagna, Meldola, Italy; [s]Division of Dermatology, Medical University of Graz, Graz, and [t]Department of Dermatology, University of Vienna Medical School, Vienna, Austria; [u]Instituto de Investigaciones Médicas A. Lanari, Universidad de Buenos Aires, Buenos Aires, Argentina; [v]Department of Dermatology, Homerton University Hospital, London, UK; [w]Aikmans Road Clinic, Christchurch, New Zealand; [x]Department of Dermatology, Tokyo Women's Medical University Medical Center East, Tokyo, and [y]Department of Dermatology, Shinshu University School of Medicine, Matsumoto, Japan; [z]Dermatology Department, Hospital Clinic of Barcelona, Barcelona, Spain

Key Words
Acral melanoma · Dermoscopy · Caucasian population

Abstract
Background: Most studies on dermoscopy of acral lesions were conducted in Asian populations. In this study, we analyzed these features in a predominantly Caucasian population. ***Objective:*** Estimate the prevalence of dermoscopic features in acral lesions, and assess their level of agreement between observers. ***Methods:*** In this retrospective multicenter study, 167 acral lesions (66 melanomas) were evaluated for 13 dermoscopic patterns by 26 physicians, via a secured Internet platform. ***Results:*** Parallel furrow pattern, bizarre pattern, and diffuse pigmentation with variable shades of brown had the highest prevalence. The agreement for lesion patterns between physicians was variable. Agreement was dependent on the level of diagnostic difficulty. ***Conclusion:*** Le-

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Ralph P. Braun, MD
Department of Dermatology
University Hospital Zurich
CH–8091 Zurich (Switzerland)
E-Mail ralph.braun@usz.ch

sions with a diameter >1 cm were more likely to be melanoma. We found as well that a benign pattern can be seen in parts of melanomas. For this reason one should evaluate an acral lesion for the presence of malignant patterns first.

Objectives

The objectives of this work were to estimate the prevalence of dermoscopic features in acral lesions and to assess the level of agreement between observers for these features.

Materials and Methods

Most of the publications pertaining to the dermoscopic features of acral melanoma and nevi are derived from research conducted in Asian patient populations [1–7]. This may be primarily due to the fact that acral melanoma is the most frequent melanoma subtype encountered in people of Asian descent [8]. The aim of the present study is to analyze the dermoscopic features of acral melanoma and acral nevi in a Caucasian population. Our second aim was to assess the interobserver agreement of these criteria.

Image Collection

We asked the members of the International Dermoscopy Society (http://www.dermoscopy-ids.org/) to submit clinical and dermoscopic images of histopathologically confirmed cases of acral melanoma. Patients at each participating institution gave their written or oral consent at the time the images were acquired that these could be utilized for research purposes in the future.

For a melanoma to be included in the study, the dermoscopic image/s had to be sharply in focus and the diagnosis had to be confirmed histopathologically. After the initial acral melanoma case collection phase, dermoscopy images of all melanomas were independently reviewed by 2 physicians with experience in dermoscopy (R.P.B., O.G.). A case was included in the image set if both physicians independently agreed on the diagnosis of melanoma based on the dermoscopic image. If there was discordance between the dermoscopic and histopathological diagnosis, the participating institution/physician was requested to submit the original histopathological slide/s of the corresponding case. These histopathology slides were then independently reviewed by a panel of 3 experienced dermatopathologists, and the lesion was only included in the study if at least 2 of the pathologists diagnosed the lesion as a melanoma.

We also asked the participants to submit clinical and dermoscopy images of cases of benign acral nevi. Clinically atypical-appearing acral nevi that were subjected to biopsy were included into this study only if accompanied by the histopathology report confirming the diagnosis. In order to avoid a selection bias favoring clinically difficult to diagnose nevi, we collected clinically typical-appearing acral nevi even if they were not biopsied. The justification for this is based on the fact that for dermoscopists, the standard of care for diagnosing typical, benign acral nevi is clinical and dermoscopic examination. All benign lesions were randomly chosen and independently reviewed by 2 experienced dermoscopists (R.P.B. and O.G.) and only included into the study if both agreed independently on the diagnosis. By the end of the data collection, we realized that all benign lesions had histopathology available and so included only benign lesions with histopathological examination. Similar to the protocol used with melanomas, if there was discordance between the 2 evaluations or between dermoscopy diagnosis and histopathological diagnosis, the participants were asked for the original histopathological slide and the same panel of dermatopathologists reviewed the cases. The case was only included if the pathologists confirmed the diagnosis of a benign acral nevus.

A lesion which would not fit the field of view would be considered to be larger than 10 mm of diameter; the ones that would fit the field of view would be considered to be smaller than 10 mm.

For a lesion, which did not fit the field of view, more than 1 image was available so it would be possible to evaluate the entire lesion.

After the images had been collected into an image set, 2 experienced dermoscopists (R.P.B. and O.G.) performed a final review (benign and malignant) and evaluated each lesion for the level of diagnostic difficulty as: 'easy', 'intermediate' and 'difficult' to diagnose.

Internet Portal

To enable multiple dermoscopists to view and assess these lesions, we developed an Internet platform which allowed secured access to the images as well as data collection. The system required a personalized login (user name and password), which was unique for every participant. No patient data was available, and none of the patients were identifiable.

Dermoscopy Criteria

We performed a literature search on dermoscopy of acral nevi and acral melanoma in April 2003 and included all dermoscopy criteria that were published to date in medical textbooks or journals [1, 9, 10]. We identified a total of 13 previously described criteria, which we used for this study. A detailed list of the criteria can be found in table 1. Although some of these criteria were well established, others were not well known or had been mentioned only once in an isolated publication. This being said, our concern was that some participants might not be familiar with the terminology of the 13 criteria used. For this reason, we prepared an online tutorial defining all criteria and showing examples of each criterion. This tutorial was available to the participant at any time during the evaluating phase of the study. Needless to say that none of the cases used in the tutorial were included in the study lesion data set.

Evaluation Phase

After the personal login, the participants had to evaluate every case in the following sequence.

First, they were asked to answer the following questions based on the *clinical picture:* (1) Is the lesion benign, suspect or malignant? (2) What is your diagnosis? (3) What is your suggested management (do nothing, follow up, surgical removal)?

Next, participants were presented with the *dermoscopy image* and were asked to answer the same 3 questions. In addition they had to evaluate the dermoscopy images for the presence of the 13 dermoscopy patterns listed in table 1. Once the participants had answered all questions, they were instructed to 'submit' the case to the study coordinator. All participants' answers were recorded in

Table 1. Observed prevalence of dermoscopic characteristics of acral lesions

	Definition	Prevalence
Benign patterns		
Parallel furrow pattern	Linear pigmentation, predominantly localized to the furrows	23.8%
Lattice-like pattern	Similar to the parallel furrow pattern with the addition of parallel pigment bands that cross over the ridges from one furrow to the next	9.8%
Lattice-like pattern with dots	In addition to the previous pattern, this pattern has some dots	7.8%
Fibrillar pattern	Dense fibrillar pigmentation composed of multiple thin parallel lines that cross both the furrows and ridges; the lines have a transverse orientation in relation to the furrows and ridges	12.0%
Pattern with globules	Any pattern which exhibits roundish structures larger than 0.1 mm in diameter (globules)	7.8%
Ladder pattern	Two pigmented lines paralleling the furrows	4.4%
Benign pattern with dots and globules	Any benign pattern in association with small (dots) and larger (globules) roundish structures	4.3%
Malignant patterns		
Parallel ridge pattern	Linear pigmentation of the ridges	17.6%
Bizarre pattern	Combination of many pigmentation patterns (multicomponent pattern)	26.2%
Diffuse pigmentation of variable shades of brown	Diffuse pigmentation of different shades of brown color not respecting furrows or ridges	20.5%
Milky red areas	Presence of reddish whitish colors	19.4%
Peripheral dots and globules	Presence of roundish structures of different sizes at the periphery of a lesion	12.1%
Ends abruptly at periphery	Abrupt cutoff of the lesion without transition towards normal skin	10.2%

a server-based database. Once this was done, the participants were given access to the next case, which was randomly chosen from the image database until they had completed the evaluation of all study cases.

Statistical Analysis

Descriptive statistics were used to characterize the dermoscopic features of the study lesions. Agreement between observers was assessed using percent agreement and κ, a measure of chance-corrected agreement by 2 or more raters. Levels of κ less than 0.4 represent poor agreement, values between 0.4 and 0.75 represent fair to good agreement and values greater than 0.75 denote excellent agreement [11, 12]. Our a priori hypothesis was that 'negative' dermoscopic features of acral lesions (i.e. less likely to be observed in melanoma) will be inversely associated with melanoma status, and 'positive' features will be positively associated with melanoma status. The dependent variable was melanoma status, coded as a dichotomous variable, and the independent variables were the dermoscopic features. Each of the dermoscopic variables was assessed in a univariate random effects logit model, with physician included as a random effect. We followed this approach since each dermoscopy expert reviewed multiple lesions. For the negative features, the dependent variable was reverse coded that all odds ratio (OR) estimates were >1.0. Since there were 3 levels of complexity to the lesions, stratified analyses based on level of difficulty were performed. All statistical analyses were performed in Stata v.10.1, Stata Corp, College Station, Tex., USA.

Results

A total of 183 lesions were collected and reviewed for inclusion. Sixteen lesions did not have a clinical image available for evaluation and were not analyzed. The study data set included 167 lesions (101 benign and 66 malignant). Of the 31 colleagues who initially agreed to participate in this study, 26 completed the evaluation of all 167 cases. These 26 colleagues had differing degrees of expertise with some being experts (n = 9).

Histopathologically, of the 101 benign lesions, 62 (61.4%) were compound nevi, 35 (34.6%) were junctional nevi and 4 (3.9%) were subcorneal hemorrhages. Based on the evaluation of the dermoscopic images, 76 (45.5%) lesions were determined to be 'easy' to diagnose, 48 (28.7%) were considered 'moderately difficult' and 43 (25.7%) were 'very challenging'. Eighty-two (81.2%) of the benign lesions were smaller than 10 mm in diameter as compared to only 21 (31.8%) of the melanomas ($p < 0.001$).

The prevalence of the 13 dermoscopic patterns is presented in table 1. The most frequently reported characteristics were parallel furrow pattern, bizarre pattern, and diffuse pigmentation with variable shades of brown, each with a prevalence of greater than 20%. When evaluating

Table 2. Level of agreement (κ) between reviewers by lesion difficulty and level of expertise of dermoscopist for all dermoscopic patterns

Pattern	Overall	Lesion difficulty			Level of expertise	
	(n = 167)	easy (n = 76)	moderate (n = 48)	very challenging (n = 43)	nonexpert (n = 17)	expert (n = 9)
Parallel furrow pattern	0.46	0.49	0.32	0.34	0.48	0.41
Lattice-like pattern	0.32	0.39	0.21	0.17	0.34	0.26
Lattice-like pattern with dots	0.25	0.26	0.35	0.14	0.28	0.21
Fibrillar pattern	0.62	0.53	0.66	0.66	0.59	0.69
Pattern with globules	0.13	0.11	0.14	0.12	0.11	0.15
Ladder pattern	0.28	0.25	0.24	0.37	0.25	0.30
Benign pattern with dots and globules	0.16	0.14	0.22	0.12	0.13	0.21
Parallel ridge pattern	0.44	0.49	0.46	0.26	0.42	0.49
Bizarre pattern	0.31	0.44	0.28	0.15	0.31	0.31
Milky red areas	0.38	0.41	0.41	0.28	0.36	0.40
Diffuse pigmentation	0.29	0.38	0.28	0.16	0.30	0.26
Peripheral dots and globules	0.32	0.38	0.29	0.24	0.29	0.35
Ends abruptly at periphery	0.26	0.29	0.25	0.23	0.26	0.27

the total number of different dermoscopy criteria per lesion, 53.3% of the lesion assessments only recognized a single dermoscopic characteristic, 26.6% identified 2, and 20.1% of assessments documented 3 or more.

In order to evaluate whether the observers were assessing the lesions in a similar fashion, the level of agreement for lesion patterns between physicians was determined. Table 2 presents the level of agreement between multiple observers for all 13 dermoscopic characteristics. Overall κ values ranged from 0.13 to 0.62. The fibrillar pattern had excellent agreement with an overall κ of 0.62. Parallel ridge and parallel furrow pattern also showed good levels of agreement. When exploring the levels of agreement by lesion difficulty, the lowest levels of agreement were observed in the most challenging lesions to assess, and there was a trend in decreasing agreement as lesion difficulty increased. For several features (bizarre pattern, diffuse pigmentation, milky red areas and parallel ridge pattern) there was a marked decrease in agreement as lesion diagnostic difficulty increased. No dramatic differences were observed by level of reviewer expertise.

Based on previous publications, our hypothesis was that 'negative' (i.e. benign) dermoscopy patterns/features of acral lesions would be inversely associated with melanoma status and 'positive' (i.e. malignant) patterns positively associated with melanoma status. The data are presented in table 3. The data for negative features were reverse coded so that the OR would be >1.0 if the feature was present in a benign lesion. These data indicate that lesions with a low level of diagnostic difficulty follow current wisdom on acral lesions, with positive and negative features being associated with melanoma and benign lesions, respectively. The odds ratios for the negative features ranged from 1.4 to 79.6, and only the criterion 'pattern with globules' failed to reach statistical significance. The general trend for the OR followed a similar pattern for the intermediate difficult-to-diagnose lesions. However, for these intermediate difficulty lesions some of the OR for the 'positive' features were somewhat attenuated. This means that positive features were not as predictive for lesions with an intermediate degree of diagnostic difficulty. This is especially the case for the parallel ridge pattern, bizarre pattern and diffuse pigmentation of variable shades of brown. The data for positive and negative features 'very challenging' lesions varies greatly. For the 'negative' features, the results are consistent with expectations with parallel furrow pattern, lattice-like pattern with dots, fibrillar pattern and pattern with globules all being more likely to be observed in benign lesions. However, for 'positive' features, the only feature that was directly associated with melanoma was milky red areas (OR = 1.5, 95% CI = 1.2–2.0, p = 0.002), and peripheral dots and globules was inversely associated with melanoma status (OR = 0.6, 95% CI = 0.4–0.8, p = 0.006). This 'contrary to expectation' result is probably due to the methodology used in classifying lesions since melanomas lacking features allowing for the dermoscopic diagnosis of melanoma were classified as 'very challenging' lesions. These melanomas were excised based on factors other than dermoscopic features such as history of change or patient concerns.

Table 3. Relationship between dermoscopic patterns and melanoma status

Dermoscopic patterns/structures	Pattern/ structure type	Lesion diagnostic difficulty					
		easy (n = 76)		moderate (n = 48)		very challenging (n = 43)	
		OR	p value	OR	p value	OR	p value
Parallel furrow pattern	negative	27.6 (17.7–42.9)	<0.001	4.6 (3.1–6.9)	<0.001	4.5 (2.9–6.9)	<0.001
Lattice-like pattern	negative	79.6 (19.7–320.9)	<0.001	3.7 (2.2–6.2)	<0.001	1.1 (0.7–1.8)	0.62
Lattice-like pattern with dots	negative	14.8 (6.5–33.7)	<0.001	20.3 (8.2–50.3)	<0.001	3.5 (1.9–6.4)	<0.001
Fibrillar pattern	negative	3.6 (2.3–5.6)	<0.001	15.1 (8.9–25.6)	<0.001	2.1 (1.4–3.2)	<0.001
Pattern with globules	negative	1.4 (0.9–2.2)	0.10	2.9 (1.9–4.5)	<0.001	2.1 (1.3–3.3)	0.002
Ladder pattern	negative	10.9 (4.8–24.9)	<0.001	15.9 (4.9–51.4)	<0.001	2.9 (0.8–10.1)	0.10
Benign pattern with dots and globules	negative	4.4 (2.0–9.6)	<0.001	36.6 (8.9–150.2)	<0.001	1.5 (0.8–2.8)	0.16
Parallel ridge pattern	positive	18.4 (13.7–24.8)	<0.001	8.4 (5.8–12.2)	<0.001	1.4 (0.9–1.9)	0.09
Bizarre pattern	positive	33.8 (23.5–48.9)	<0.001	6.9 (5.0–9.5)	<0.001	1.0 (0.8–1.3)	0.78
Milky red areas	positive	22.3 (15.4–32.3)	<0.001	10.9 (7.5–15.9)	<0.001	1.5 (1.2–2.0)	0.002
Diffuse pigmentation	positive	55.7 (36.1–85.7)	<0.001	27.1 (16.0–45.7)	<0.001	1.2 (0.9–1.6)	0.20
Peripheral dots and globules	positive	17.9 (11.9–26.8)	<0.001	8.1 (5.2–12.4)	<0.001	0.6 (0.4–0.8)	0.006
Ends abruptly at periphery	positive	10.2 (7.1–14.8)	<0.001	7.3 (4.5–11.9)	<0.001	0.9 (0.6–1.4)	0.76

Separate models were created from easy, medium and very challenging lesions. Figures in parentheses are 95% CI.

Table 4. Cross-classification of whether the dermoscopic evaluation changed the clinical management of the lesion, by the diagnostic category of the lesion (benign or malignant) stratified by the three levels of lesion difficulty

Dermoscopy changed lesion management (whether to excise or not)	Lesion diagnostic difficulty								
	easy (n = 76)			moderate (n = 48)			very challenging (n = 43)		
	overall	benign	malignant	overall	benign	malignant	overall	benign	malignant
No	92.8%	90.8%	96.9%	90.5%	86.3%	94.7%	82.5%	80.6%	85.3%
Yes	7.2%	9.2%	3.1%	9.5%	13.7%	5.3%	17.5%	19.4%	14.7%
p value		<0.001			<0.001			0.045	

Lesion difficulty was evaluated by 2 independent observers based on clinical and dermoscopy examination.

Dermoscopic assessment played an important role in the proposed lesion management (table 4). The addition of dermoscopic evaluation changed the decision to biopsy or not biopsy a lesion 10.5% of the time (n = 455) from the clinical to the dermoscopic evaluation. The change in lesion management was positively associated with lesion difficulty. With the addition of dermoscopy, the decision whether to excise the lesion changed 7.2% of the time for easy lesions, 9.5% for moderate lesions and 17.5% for very challenging lesions ($p_{trend} \leq 0.001$). With the addition of dermoscopy, management changed in favor of biopsying a lesion 5.4% of the time and against biopsying the lesion 5.1%. This change in management led to a false-positive rate of 4% and a false-negative rate of 1.3%.

Discussion

With 66 acral melanomas this is the largest series on dermoscopy of acral melanoma in a predominantly Caucasian population to date [13–16]. Eight lesions (3 melanomas) were from Asian patients. Since this was a retrospective study that relied on previously captured images of acral lesions, the possibility of selection bias towards more difficult to diagnose lesions exists. This might occur as a result of clinicians failing to capture images of the more typical acral lesions encountered in practice. In contrast, 'interesting' lesions, which are often challenging to diagnose, are more likely to attract attention resulting in them being documented via image capture. We at-

tempted to minimize this selection bias for the group of benign lesions by including clear-cut benign acral nevi.

Saida et al. [17–19] were the first to recognize the importance of the maximum diameter of acral lesions for the diagnosis of melanoma. They observed that acral lesions with a diameter >7 mm are much more likely to be melanoma, irrespective of the dermoscopic patterns or structures; our data strongly corroborates this finding. Although the exact diameter of melanomas >1 cm in maximum diameter could not be determined due to fact that these melanomas were larger than the captured image field of view of 1 cm (i.e. diameter of the dermoscopy lens), we did know that these lesions were at least 1 cm in greatest diameter. We observed that lesions with a diameter of more than 1 cm, independently from their clinical or dermoscopy morphology, were much more likely to be melanomas than lesions with a smaller diameter.

Concerning the dermoscopy criteria, we included all criteria that had been published prior to the initiation of this study. Our aim was to determine their usefulness for the diagnosis of acral melanoma. Despite the fact that participants had the option to select as many dermoscopy criteria as they thought they perceived in any given pigmented lesion, we found that the different dermoscopy criteria had an overall low prevalence: 53.3% of the acral lesions had a single dermoscopy criterion. For this reason we think that the term 'dermoscopy pattern' is more appropriate and should replace the term 'dermoscopy criteria' in this context. Some of the dermoscopy patterns were well known, and all participants were familiar with them including: parallel ridge pattern, parallel furrow pattern, lattice-like pattern and fibrillar pattern. These well-known patterns had the highest prevalence as well as the highest κ values (tables 1, 2). In order to overcome this potential anchoring or search satisfaction bias resulting from the observer's ability to easily recognize a given criterion, we provided a detailed online tutorial for the participants. Even though we had taken this precaution, the 'classic' well-known criteria still had higher prevalence and κ values than 'newer' criteria, which may not have been recognizable to some observers. Further support for this bias is derived from analyzing the prevalence values of synonymous patterns. For example, what is called 'ladder pattern' by one author was called 'parallel furrow pattern of the double line variant' by another. Since the latter term is more commonly used, it had a higher prevalence. Another factor contributing to the low prevalence of each of the 13 patterns is that most lesions in the study only manifested a single dermoscopy pattern and since we used 13 different dermoscopy patterns, each pattern had a low prevalence.

It is important to notice that a low prevalence has an important influence on the statistical measurement of agreement since it will artificially depress κ values and the agreement will be underestimated. This being said, since these patterns had the highest prevalence, it is not surprising that these features also had the highest agreement.

The agreement between the observers was variable but was best for the well-established dermoscopy patterns such as fibrillar pattern, parallel ridge pattern and parallel furrow pattern [1]. The fact that these patterns are easily recognizable may help explain their higher prevalence and better interobserver agreement. The interobserver agreement was significantly lower for the newer and less well-established criteria such as ladder pattern, patterns with globules, and benign pattern with dots and globules. For example the ladder pattern is considered to be a variant of the parallel furrow pattern and is not taught in most dermoscopy courses.

The level of expertise of the clinician did not significantly affect interobserver agreement. Experts, however, had higher levels of agreement in 8 out of the 13 patterns, many of which included the newer or less well-established dermoscopy criteria. This should not come as a surprise since it is intuitive that 'experts' will be more knowledgeable about newer dermoscopy criteria as compared to nonexperts. However, expertise is not necessary to recognize well-established and easy to recognize patterns, which in turn explains the lack of difference between the interobserver agreement among experts and nonexperts.

The dermoscopy diagnostic criteria of pigmented lesions in special locations such as acral sites differ from those of nonglabrous skin. This is primarily due to differences of skin anatomy, which results in distinctive dermoscopy patterns and morphology manifest in acral nevi and melanoma. Although a dermoscopist might have a high level of experience in the diagnosis of pigmented lesions on nonglabrous skin, this does not automatically translate into expertise in the diagnosis of acral lesions.

Analyzing the data on the degree of difficulty of a lesion, we found that the higher the level of diagnostic difficulty, the lower the agreement between the participants. There was as well a clear trend in decreasing interobserver agreement with increasing level of diagnostic difficulty of a lesion. One explanation for this might be that lesions without an obvious dermoscopy pattern were more likely to be categorized as difficult to diagnose lesions at the outset of the study. Another possibility is that lesions manifesting a morphology that did not conform to one of the 13 dermoscopy acral patterns were more likely to be classified as a difficult to diagnose lesion at the outset of

the study. For example, thick acral melanomas often present as unspecific amelanotic reddish nodules. They are easy to diagnose clinically but often lack easily recognizable, specific dermoscopic features

Although none of the lesions in this study crossed over Wallace's line, it is important to remember that lesions overlying this line can be challenging to diagnose. This demarcation line separates acral from nonglabrous skin. Lesions situated on this demarcation line are difficult to diagnose because one part of the lesion is on normal (nonglabrous) skin and the other part on acral (glabrous) skin. Since the dermoscopic architecture of the lesion will differ in the portion of the lesion above and below Wallace's line due to differences in skin anatomy, different diagnostic criteria have to be applied to the portion of the lesion above and below this demarcation line.

An important observation that needs emphasizing is that classic benign dermoscopy patterns may be focally present within any melanoma. However, no melanoma in our data set manifested an exclusively benign pattern without also revealing focal melanoma-specific criteria somewhere within the lesion. For this reason, we recommend to first search the entire area of the lesion for the presence of any malignant dermoscopy patterns and if seen, even if present focally, subject the lesion to histopathology evaluation. However, if neither malignant nor benign patterns are visible, then the diagnosis of melanoma cannot be ruled out and the lesion should be excised in order not to miss a featureless melanoma.

We found that all of the lesions displaying a classic benign or malignant pattern were easy to diagnose lesions. Only 2 patterns were not statistically significant in their ability to differentiate benign from malignant: 'patterns with globules' and 'benign patterns with dots and globules'. Although the OR were lower, the same trends were observed for melanomas categorized as 'intermediate difficult to diagnose' lesions (table 4). In contrast, for lesions with a high degree of diagnostic difficulty the results were initially surprising (table 4); while the OR were <1 for the benign patterns, the OR were also <1 for the malignant patterns implying that all patterns are negatively associated with melanoma. Although at first glance this appears contrary to expectation, this result can be explained as a bias resulting from the method used to classify lesions into diagnostically easy, intermediate and challenging groups. Acral melanomas lacking obvious diagnostic features were all classified as 'difficult to diagnose' lesions. The challenging lesions were categorized by visual examination by experts in dermoscopy. Therefore, it is not surprising that we did not identify strong positive predictors of melanoma status. In other words, challenging lesions are difficult to diagnose because they do not exhibit a diagnostic dermoscopy pattern.

Perhaps the most important finding in this study was that dermoscopic assessment changed the dermatologist's clinical management of the lesion. We cross-classified whether the observer changed his/her clinical management based on the dermoscopic findings; overall 89.5% of the responses indicated no change in management after the dermoscopic images had become available. However, as the level of lesion difficulty increased, the observers relied more heavily on dermoscopic evaluation to guide their clinical management of the lesion (table 4). For easy to diagnose lesions only 7.2% of the clinical decisions were affected by dermoscopic evaluation, and this percentage increased to approximately 9.5 and 17.5% for 'intermediate' and 'difficult' to diagnose lesions, respectively. Overall, the change in management with the addition of dermoscopy was modest (10.5% of lesion evaluations). In a majority of these cases, the change in management was in the appropriate direction.

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