Published in final edited form as:

Dermatol Clin. 2017 October ; 35(4): 417–437. doi:10.1016/j.det.2017.06.003.

Enhancing Skin Cancer Diagnosis with Dermoscopy

Zachary J. Wolner, BA,

Memorial Sloan Kettering Cancer Center, 16 E 60th Street, Suite 4302, NY, NY 10022,
(646)-888-6267

Oriol Yelamos, MD,

Memorial Sloan Kettering Cancer Center, 16 E 60th Street, Suite 4302, NY, NY 10022,
(646)-888-6269

Konstantinos Liopyris, MD,

Memorial Sloan Kettering Cancer Center, 16 E 60th Street, Suite 4302, NY, NY 10022

Tova Rogers, MFA,

Memorial Sloan Kettering Cancer Center, 16 E 60th Street, Suite 4302, NY, NY 10022

Michael A. Marchetti, MD, and

Memorial Sloan Kettering Cancer Center, 16 E 60th Street, Suite 4302, NY, NY 10022,
(646)-888-6016

Ashfaq A. Marghoob, MD

Memorial Sloan Kettering Cancer Center, 16 E 60th Street, Suite 4302, NY, NY 10022,
(646)-888-6017

Synopsis

Dermoscopy increases the sensitivity for skin cancer detection, decreases the number of benign lesions biopsied for each malignant diagnosis, and enables the diagnosis of thinner melanomas compared to naked eye examination. Three meta-analyses have all identified that dermoscopy improved diagnostic accuracy for melanoma when compared to naked eye exam. In addition, studies have established that dermoscopy can aid in the detection of keratinocyte carcinomas. Dermoscopy triage algorithms have been developed to help novices decide when a biopsy or a referral is most appropriate. In this chapter we illustrate the dermoscopic features that assist in identifying melanoma and keratinocyte carcinomas.

Correspondence to: Zachary J. Wolner.

Permissions: Natalia Jaimes, M.D. has granted us permission to use select schematics throughout this article. Natalia Jaimes, M.D. and we retain the copyright to any line drawing included in this submission.

Conflict of interest: The authors have no conflicts of interest to declare.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Keywords

dermoscopy; dermatoscopy; epiluminescence; diagnostic accuracy; sensitivity; specificity; odds ratio; melanoma; squamous cell carcinoma; SCC; basal cell carcinoma; BCC; 2-step algorithm; triage amalgamated diagnostic algorithm; TADA; regression structures; negative network; leaflike; pseudopods; arborizing vessels; shiny-white structures

Introduction

Dermoscopy has been shown to increase sensitivity for skin cancer detection, decrease the benign to malignant biopsy ratio, and allow for the diagnosis of thinner melanomas compared to naked eye exam (NEE).^{1–3} In 2009, a survey of academic dermatologists and chief residents in US dermatology training programs demonstrated that 84% of attending dermatologists used dermoscopy in daily practice and 90.2% of chief dermatology residents received dermoscopy training as part of their curricula.⁴ These findings represented a significant increase in training and use of dermoscopy compared to a similar survey performed ten years prior.⁵ The use of dermoscopy has also increased among nondermatologist physicians who actively participate in skin cancer management, such as family physicians.^{6–8}

Despite the growing number of practitioners incorporating dermoscopy into their daily practices, there remain significant barriers, like lack of training resources, preventing its widespread adoption.⁴ Dermoscopic teaching methodologies, which include pattern analysis, diagnostic algorithms, and simplified triage algorithms, continue to emerge. They aim to provide an entry point in educating beginners in dermoscopy. Here we review the diagnostic utility of dermoscopy for detection of melanoma and keratinocyte carcinoma (KC; also known as nonmelanoma skin cancers) and outline the specific dermoscopic features that can help discriminate these cancers from benign lesions. A review of dermoscopic teaching methodologies, including triage algorithms, is also provided.

Dermoscopy for the diagnosis and management of cutaneous melanoma

In 2001, the first meta-analysis of the diagnostic power of dermoscopy found dermoscopy to be more accurate than NEE alone for the diagnosis of cutaneous melanoma.⁹ Two additional meta-analyses have since reinforced these findings.^{2,10} The most recent, by Vestergaard et al, included only prospective studies performed in a clinical setting, and thus more accurately reflected everyday dermoscopy use.² In total, 8 487 suspicious pigmented and nonpigmented lesions were included and melanoma prevalence ranged from 0.5% to 21.1% with a Breslow thickness that ranged from 0.35 to 0.95 mm.² Dermoscopic and clinical accuracy were evaluated through the diagnostic odds ratio (DOR) which considers both sensitivity and specificity and their respective trade-offs.² The DOR for dermoscopy was 15.6 (CI: 2.9–83.7, P=0.016) times higher for dermoscopy than NEE. A summary estimate of sensitivity was higher with dermoscopy (0.90, CI: 0.80–0.95) than for NEE (0.71, CI: 0.59–82, P=0.002);² although specificity was higher for dermoscopy (0.90, CI: 0.57–98) than NEE (0.81, CI: 0.48–0.95, P=0.18), it was not statistically significant.²

In all three meta-analyses, diagnostic accuracy was dependent upon the experience of the examiner.^{2,9,10} However, inexperienced users, after a two-hour course, had an improved sensitivity without compromising their specificity.² Terushkin et al found, through assessment of the benign-to-malignant biopsy ratio (BMR), that a single dermatologist newly adopting dermoscopy experienced a learning curve. Initially, the BMR of the dermatologist increased compared to NEE, but with time and experience, the BMR dropped below the baseline value with NEE alone and approached the level of pigmented lesion specialists.¹¹ Several studies have demonstrated that short training modules can improve the diagnostic performance of inexperienced dermatologists, general practitioners, and even medical students.^{6,12,13} However, the training modalities have varied widely among studies and the ideal teaching method for beginners remains to be standardized.

The BMR (which is directly related to positive predictive value), while not a surrogate, is impacted by the sensitivity and specificity of dermoscopy. Improvements in this ratio suggest that the increased sensitivity seen with dermoscopy does not entail an increase in the number of unnecessary biopsies and thus an increase in morbidity. Carli et al retrospectively examined two users before and after the introduction of dermoscopy and four nonusers. Analysis demonstrated a significant improvement in the BMR over a four-year study period in the dermoscopy arm (18:1 to 4.3:1, $P = 0.037$).¹ The BMR for nonusers had no significant difference at the beginning and the end of the study (11.8:1 to 14.8:1).¹ In a randomized controlled trial comparing one-time evaluations of equivocal pigmented lesions with dermoscopy or NEE, 9% of patients followed with dermoscopy were referred for biopsy or excision compared to 15.6% with NEE ($P=0.013$). The reduction in surgical morbidity was not hindered by a decreased ability to diagnose melanoma.¹⁴ Finally, a multicenter survey over ten years showed that the BMR at sites dedicated to skin cancer treatment improved from 12.8 to 6.8 ($p<0.001$) and remained unchanged in sites not dedicated to screening for skin cancer. The authors of that study argue that the introduction of dermoscopy was largely responsible for the observed improvement in the BMR.¹⁵

Dermoscopy and dermoscopic screening allow for the earlier detection of melanoma and improved clinical management. Several studies have shown that dermoscopic monitoring of lesions enables the detection of thin, featureless melanomas.^{3,16} In a meta-analysis with a mean follow-up of 30 months, Salerni et al showed dermoscopy users to detect a greater number of thinner melanomas compared to NEE (mean Breslow depth 0.77 mm vs 1.43 mm, $P = <0.05$).³ Haenssle et al found that participation in specialized dermoscopic screening programs and dermoscopic examinations at the time of diagnosis were also significantly associated with thinner melanomas ($P = 0.01$).¹⁶ Dermoscopy users have identified melanoma specific dermoscopic features that have enabled them to recognize melanoma with the sensitivity and specificity described. The following sections will expand upon these melanoma specific dermoscopic features and other features for basal cell carcinoma and keratinizing carcinomas.

Dermoscopic features in melanoma

By allowing for the in vivo assessment of subsurface skin structures, dermoscopy offers a window into the histological diagnosis of skin cancers.¹⁷ Many of the described

dermoscopic features have known histological correlates. The presence of these features can provide insight into the cellular nature of skin neoplasms and allow for more precise clinical diagnoses. When the dermoscopic diagnosis is unclear, structures can hint at malignant potential. While the dermoscopic features discussed in Table 1 can be applied to any lesion on the skin, there are additional criteria in Table 2 that are specific to lesions on the face, mucosal, nails and volar surfaces, which are outlined below. Examples of dermoscopic features found in melanoma are shown in Figure 1.

Lentigo maligna and lentigo maligna melanoma both arise on sun damaged skin, most commonly the face and scalp (both lentigo maligna and lentigo maligna melanoma will be represented by the abbreviation LMM). The anatomic predilection for the face and sun damaged skin entails a broad differential diagnosis including pigmented actinic keratoses, lichen planus-like keratoses, and early-flat seborrheic keratoses.¹⁸ Dermoscopy can help the user sort through the numerous diagnoses. Facial skin has a flattened dermoepidermal junction resulting in absence of traditional reticular patterns commonly seen in melanocytic lesions. Instead, the pigmentation is punctuated by adnexal structures creating a pseudonetwork.¹⁹ LMM specific structures include: asymmetrical pigmentation of follicular openings, dots aggregated around adnexal openings, polygonal lines and rhomboid structures, and dark blotches with or without obliteration of the adnexal openings (Figure 2A).^{18,20,21}

Additional dermoscopic features are also needed to evaluate for melanoma arising on the nail apparatus, mucosa or volar skin. In melanoma of the nail apparatus, dermoscopy of the pigmented band will show multiple brown to black lines with irregular arrangement and thickness and possible areas of pigment interruption (Figure 2B).²² The mucosa comprises a wide range of anatomic sites such as the lip, glans penis, anogenital orifice, labia, and praeputium. On dermoscopy, an early sign of mucosal melanoma is the presence of structureless areas and a gray color. More advanced melanoma can present with multiple patterns and colors, particularly white, blue, and/or gray (Figure 2C).^{23,24} The dermoscopic appearance of acral lentiginous melanoma (ALM) is shaped by the unique furrow and ridge pattern of acral volar skin surfaces. Melanocytic features specific to ALM are the parallel ridge pattern and irregular diffuse pigmentation (Figure 2D).²⁵ Table 1 and 2 provide an overview of melanoma specific criteria, including definitions, pictorial examples, and reported sensitivities, specificities, and odds ratios. This list was compiled using the most recent definitions of dermoscopic criteria published by the International Dermoscopy Society in 2016.²⁶

Dermoscopy for the diagnosis and management of keratinocyte carcinomas

In addition to differentiating nevi from melanoma and detecting early melanoma, dermoscopy can also be used to detect KC. Rosendahl et al examined 217 consecutive pigmented nonmelanocytic lesions, of which 138 were malignant, with both dermoscopy and NEE. They reported a diagnostic improvement with dermoscopy of 0.89 (area under Receiver Operating Curve) compared to 0.83 with NEE alone ($P<0.001$).²⁷ In 2016 a two

part study of optional then mandatory dermoscopy use, the overall diagnostic sensitivity of basal cell carcinoma (BCC) was 93.3% (91.9–94.5) and specificity was 91.8% (90.6–93.0).²⁸ Furthermore, dermoscopy when compared to NEE was shown to help predict BCC histopathology subtypes.²⁸ In the following sections, we will detail further the specific diagnostic features of KC.

Dermoscopic features in basal cell carcinoma

BCCs are broadly classified as pigmented or nonpigmented. While most BCCs on NEE are nonpigmented, 29.8% of these lesions actually reveal pigment structures when viewed with dermoscopy.²⁹ The pigmented structures seen in BCC include blue-grey globules or ovoid nests, spoke-wheel structures and leaflike areas. The structures seen in nonpigmented or pigmented BCC include arborizing vessels, shiny white blotches and strands (seen with polarized dermoscopy) and ulcers/erosions (Table 3).^{30–32} Studies have demonstrated that certain dermoscopic structures and patterns are associated with different subtypes of BCC.^{28,33} The presence of spoke-wheel and leaflike structures, multiple small erosions, short fine vessels and shiny white blotches and strands in a nonpalpable lesion are associated with superficial BCC. In contrast, the presence of blue-grey globules, ovoid nest, arborizing vessels and ulceration are associated with nodular BCC.^{28,33} Examples of dermoscopic features found in BCC are shown in Figure 3.

Dermoscopic features in actinic keratoses, squamous cell carcinoma in situ/Bowen disease, invasive squamous cell carcinoma, and keratoacanthoma

Dermoscopic features have been identified that can assist in diagnosing actinic keratoses (AK), Bowen disease (BD) or in situ squamous cell carcinoma (full thickness atypia) (IEC), invasive squamous cell carcinoma (SCC), and keratoacanthoma (KA). Dermoscopically, these lesions exist on a spectrum that we have grouped under the category of keratinizing skin cancer (KSC), thus several features, such as scale, vascular structures, and erythema, are ubiquitous among them. While more research is needed to determine the sensitivity and specificity of these features, it appears we can tease out the full spectrum of KSCs. Dermoscopy users can differentiate AKs and in situ SCC and SCC.

There are several notes that need to be made concerning the data presented in Tables 4, 5, and 6. Many of the lesions examined occur in higher frequency on the head and neck, thus making generalizability to KSCs on other body parts difficult.^{18,34} In addition, several studies look at specific comparisons of the dermoscopic features of AK, for example, to those of SCC, but not all possible diagnoses.^{21,35} When a definition was absent from the International Society of Dermoscopy 2016 consensus meeting²⁶, we cited definitions provided from other sources. Finally, while purported to be significant, some feature have yet to be rigorously studied to determine their diagnostic significance. The table below represents our best representation of available data and, hopefully, makes clear when little analytic information is known. In addition, examples of dermoscopic features found in KSC are shown in Figure 4.

Dermoscopy algorithms

Pehamberger et al first described pattern analysis in dermoscopy as a diagnostic aid to supplement clinical exam of pigmented skin lesions.^{36,37} Pattern analysis is the assessment of the heterogeneity in a pigmented lesion's overall structure, colors, patterns, and margins.³⁶ Pattern recognition, when used by experts, has been shown to have the best diagnostic performance when compared to other methods;³⁸ yet, this technique is developed through years of experience. For new users, algorithms are often needed to sift through the diverse array of presentations of any given type of neoplasm. With the number of new dermoscopy users ever on the rise⁴ along with the inclusion of dermoscopy in national management guidelines^{39–41}, algorithms that address skin cancer management as well as diagnosis has become essential.

Although there are multiple algorithms used to teach dermoscopy the authors rely on the 2-step algorithm.⁴² The first step differentiates melanocytic from nonmelanocytic lesions. The second step separates benign from malignant melanocytic lesions.³⁸ Numerous algorithms have been developed to help new users approach the second step of diagnosing melanoma with high sensitivity and specificity.⁴³ Some of these algorithms include the ABCD Rule, the 7-point checklist, the Menzies' Method, the CASH algorithm, and the "Chaos and Clues" algorithm.^{7,44–47} The latter emphasizes the importance of a disorganized distribution of dermoscopic structures in malignant lesions.⁷ While on rare occasions skin cancers lack disorganization, they can usually be identified based on the presence of starburst like pattern, negative networks, shiny white structures, and polymorphous vessels. While the aforementioned algorithms have served us well, there is still a need for simpler triage algorithms that can aid beginners in effectively screening for malignancies. Multiple attempts have been made to create a simplified triage algorithm.^{7,44–47} The triage amalgamated dermoscopy algorithm (TADA) is a new algorithm that attempts to provide a comprehensive approach to dermoscopy guided management of pigmented and nonpigmented skin cancers through a combination of previously validated criteria and features (Figure 5).^{19,31,48–53} A novel aspect of TADA is that it first asks users to determine if a lesion is an unequivocal example of a dermatofibroma, angioma, and seborrheic keratosis. If the user is confident that the lesions are one of these three, it is excluded from further evaluation with the algorithm. The TADA algorithm is not meant to evaluate lesions on the palms, soles, or nails.

The second step of TADA asks user to evaluate architectural disorder. A study led by the International Dermoscopy Society found architectural disorder, with an OR of 6.6, the most powerful discriminator of melanoma.⁴³ Furthermore, the subjective interpretation of architectural disorder had the highest interobserver agreement among participants (intraclass correlation coefficient (ICC) of 0.43, where an ICC of 0 is an agreement by chance and an ICC of 1 is perfect agreement).⁴³ The additional criteria included in TADA (starburst pattern, blue-black or gray color, shiny white structures, negative network, ulcer/erosion, and/or vessels) are needed to identify organized-appearing malignancies, such as spitzoid, nodular, and amelanotic melanoma. The presence of any one feature indicates the need for a biopsy or specialist referral.

In a pilot study, novice dermoscopy users were able to achieve a 93.3% sensitivity and 74.1% specificity using TADA for the identification of malignant study lesions (melanoma, BCC, SCC) after one day of dermoscopy training.⁵⁴ The high sensitivity seen with TADA was at the expense of specificity, however, the value seen in this study were still equivalent or better to those reported for existing triage algorithms.³⁸ Thus, with a minor increase in biopsies and referrals for unequivocal lesions, fewer malignant lesions will be missed. TADA has the remarkable potential for enhancing skin cancer screening and detection among individuals with limited dermoscopy training and experience.

Summary

Dermoscopy has been shown to increase the sensitivity and specificity for diagnosing melanoma. It also enables the diagnosis of melanoma at an earlier stage. In addition, several studies have established dermoscopy as a diagnostic aid for BCC and more recently in clinically determining its histopathological subtype. AK, BD, IEC, SCC, and KA share common dermoscopic features, although multiple specific features have been described allowing accurate diagnosis of specific tumors. Diagnostic algorithms are often used to aid in the dermoscopic evaluation and diagnosis of skin lesions. The advent of triage algorithms can assist beginners with determining if a lesion requires a biopsy or specialist referral without having to arrive at a specific diagnosis. TADA is one such algorithm that includes a limited set of dermoscopic features and can thus be easily learned and implemented by new users. The features included in TADA were selected for their abilities to discriminate a wider range of common pigmented and nonpigmented skin cancers.

Acknowledgments

Funding: This research was funded in part through the NIH/NCI Cancer Center Support Grant P30 CA008748

References

1. Carli P, De Giorgi V, Crocetti E, et al. Improvement of malignant/benign ratio in excised melanocytic lesions in the 'dermoscopy era': a retrospective study 1997–2001. *Br J Dermatol*. 2004; 150(4):687–692. DOI: 10.1111/j.0007-0963.2004.05860.x [PubMed: 15099364]
2. Vestergaard M, Macaskill P, Holt P, Menzies S. Dermoscopy compared with naked eye examination for the diagnosis of primary melanoma: a meta-analysis of studies performed in a clinical setting. *Br J Dermatol*. 2008; 159(3):669–676. DOI: 10.1111/j.1365-2133.2008.08713.x [PubMed: 18616769]
3. Salerni G, Teran T, Puig S, et al. Meta-analysis of digital dermoscopy follow-up of melanocytic skin lesions: a study on behalf of the International Dermoscopy Society. *J Eur Acad Dermatol Venereol*. Jul; 2013 27(7):805–814. DOI: 10.1111/jdv.12032 [PubMed: 23181611]
4. Terushkin V, Oliveria SA, Marghoob AA, Halpern AC. Use of and beliefs about total body photography and dermatoscopy among US dermatology training programs: an update. *J Am Acad Dermatol*. May; 2010 62(5):794–803. DOI: 10.1016/j.jaad.2009.09.008 [PubMed: 20223561]
5. Nehal KS, Oliveria SA, Marghoob AA, et al. Use of and beliefs about baseline photography in the management of patients with pigmented lesions: a survey of dermatology residency programmes in the United States. *Melanoma Res*. Apr; 2002 12(2):161–167. [PubMed: 11930113]
6. Argenziano G, Puig S, Zalaudek I, et al. Dermoscopy improves accuracy of primary care physicians to triage lesions suggestive of skin cancer. *J Clin Oncol*. 2006; 24(12):1877–1882. DOI: 10.1200/JCO.2005.05.0864 [PubMed: 16622262]
7. Rosendahl C, Cameron A, McColl I, Wilkinson D. Dermatoscopy in routine practice - 'chaos and clues'. *Aust Fam Physician*. Jul; 2012 41(7):482–487. [PubMed: 22762066]

8. Haspeslagh M, Vossaert K, Lanssens S, et al. Comparison of Ex Vivo and In Vivo Dermoscopy in Dermatopathologic Evaluation of Skin Tumors. *JAMA Dermatol.* Mar; 2016 152(3):312–317. DOI: 10.1001/jamadermatol.2015.4766 [PubMed: 26746141]
9. Bafounta M, Beauchet A, Aegerter P, Saiag P. Is dermoscopy (epiluminescence microscopy) useful for the diagnosis of melanoma? Results of a meta-analysis using techniques adapted to the evaluation of diagnostic tests. *Arch Dermatol.* 2001; 137(10):1343–1350. [PubMed: 11594860]
10. Kittler H, Pehamberger H, Wolff K, Binder M. Diagnostic accuracy of dermoscopy. *The lancet oncology.* 2002; 3(3):159–165. [PubMed: 11902502]
11. Terushkin V, Warycha M, Levy M, Kopf A, Cohen D, Polsky D. Analysis of the benign to malignant ratio of lesions biopsied by a general dermatologist before and after the adoption of dermoscopy. *Arch Dermatol.* 2010; 146(3):343–344. DOI: 10.1001/archdermatol.2010.12 [PubMed: 20231514]
12. Binder M, Puespoeck-Schwarz M, Steiner A, et al. Epiluminescence microscopy of small pigmented skin lesions: short-term formal training improves the diagnostic performance of dermatologists. *J Am Acad Dermatol.* 1997; 36(2):197–202. [PubMed: 9039168]
13. Chen L, Lieberman T, Soriano R, Dusza S, Halpern A, Marghoob A. One-year follow-up of dermoscopy education on the ability of medical students to detect skin cancer. *Dermatology.* 2013; 226(3):267–273. DOI: 10.1159/000350571 [PubMed: 23797047]
14. Carli P, de Giorgi V, Chiarugi A, et al. Addition of dermoscopy to conventional naked-eye examination in melanoma screening: a randomized study. *J Am Acad Dermatol.* 2004; 50(5):683–689. DOI: 10.1016/j.jaad.2003.09.009 [PubMed: 15097950]
15. Argenziano G, Cerroni L, Zalaudek I, et al. Accuracy in melanoma detection: a 10-year multicenter survey. *J Am Acad Dermatol.* Jul; 2012 67(1):54–59. DOI: 10.1016/j.jaad.2011.07.019 [PubMed: 21982636]
16. Haenssle H, Hoffmann S, Holzkamp R, et al. Melanoma thickness: the role of patients' characteristics, risk indicators and patterns of diagnosis. *J Eur Acad Dermatol Venereol.* 2015; 29(1):102–108. DOI: 10.1111/jdv.12471 [PubMed: 24646029]
17. Yadav S, Vossaert K, Kopf A, Silverman M, Grin-Jorgensen C. Histopathologic correlates of structures seen on dermoscopy (epiluminescence microscopy). *The American journal of dermatopathology.* 1993; 15(4):297–305. [PubMed: 8214386]
18. Tschandl P, Rosendahl C, Kittler H. Dermatoscopy of flat pigmented facial lesions. *J Eur Acad Dermatol Venereol.* Jan; 2015 29(1):120–127. DOI: 10.1111/jdv.12483 [PubMed: 24661420]
19. Marghoob, AABR., Malvehy, J., editors. *Atlas of Dermoscopy.* 2. London, U.K: Informa Healthcare; 2012.
20. Schiffner R, Schiffner-Rohe J, Vogt T, et al. Improvement of early recognition of lentigo maligna using dermatoscopy. *J Am Acad Dermatol.* Jan; 2000 42(1 Pt 1):25–32.
21. Lallas A, Tschandl P, Kyrgidis A, et al. Dermoscopic clues to differentiate facial lentigo maligna from pigmented actinic keratosis. *Br J Dermatol.* May; 2016 174(5):1079–1085. DOI: 10.1111/bjd.14355 [PubMed: 26784739]
22. Braun RP, Baran R, Le Gal FA, et al. Diagnosis and management of nail pigmentations. *J Am Acad Dermatol.* May; 2007 56(5):835–847. DOI: 10.1016/j.jaad.2006.12.021 [PubMed: 17320240]
23. Blum A, Simionescu O, Argenziano G, et al. Dermoscopy of pigmented lesions of the mucosa and the mucocutaneous junction: results of a multicenter study by the International Dermoscopy Society (IDS). *Arch Dermatol.* Oct; 2011 147(10):1181–1187. DOI: 10.1001/archdermatol.2011.155 [PubMed: 21680757]
24. Lin J, Koga H, Takata M, Saida T. Dermoscopy of pigmented lesions on mucocutaneous junction and mucous membrane. *Br J Dermatol.* Dec; 2009 161(6):1255–1261. DOI: 10.1111/j.1365-2133.2009.09251.x [PubMed: 19673880]
25. !!! INVALID CITATION !!!
26. Kittler H, Marghoob AA, Argenziano G, et al. Standardization of terminology in dermoscopy/dermatoscopy: Results of the third consensus conference of the International Society of Dermoscopy. *J Am Acad Dermatol.* Jun; 2016 74(6):1093–1106. DOI: 10.1016/j.jaad.2015.12.038 [PubMed: 26896294]

27. Rosendahl C, Tschandl P, Cameron A, Kittler H. Diagnostic accuracy of dermatoscopy for melanocytic and nonmelanocytic pigmented lesions. *J Am Acad Dermatol.* 2011; 64(6):1068–1073. DOI: 10.1016/j.jaad.2010.03.039 [PubMed: 21440329]
28. Ahnslide I, Zalaudek I, Nilsson F, Bjellerup M, Nielsen K. Preoperative prediction of histopathological outcome in basal cell carcinoma: flat surface and multiple small erosions predict superficial basal cell carcinoma in lighter skin types. *Br J Dermatol.* Oct; 2016 175(4):751–761. DOI: 10.1111/bjd.14499 [PubMed: 26921200]
29. Lallas A, Argenziano G, Kyrgidis A, et al. Dermoscopy uncovers clinically undetectable pigmentation in basal cell carcinoma. *Br J Dermatol.* Jan; 2014 170(1):192–195. DOI: 10.1111/bjd.12634 [PubMed: 24117444]
30. Menzies SW, Westerhoff K, Rabinovitz H, Kopf AW, McCarthy WH, Katz B. Surface microscopy of pigmented basal cell carcinoma. *Arch Dermatol.* Aug; 2000 136(8):1012–1016. [PubMed: 10926737]
31. Altamura D, Menzies SW, Argenziano G, et al. Dermoscopy of basal cell carcinoma: morphologic variability of global and local features and accuracy of diagnosis. *J Am Acad Dermatol.* Jan; 2010 62(1):67–75. DOI: 10.1016/j.jaad.2009.05.035 [PubMed: 19828209]
32. Liebman TN, Rabinovitz HS, Dusza SW, Marghoob AA. White shiny structures: dermoscopic features revealed under polarized light. *J Eur Acad Dermatol Venereol.* Dec; 2012 26(12):1493–1497. DOI: 10.1111/j.1468-3083.2011.04317.x [PubMed: 22035217]
33. Lallas A, Tzellos T, Kyrgidis A, et al. Accuracy of dermoscopic criteria for discriminating superficial from other subtypes of basal cell carcinoma. *J Am Acad Dermatol.* Feb; 2014 70(2):303–311. DOI: 10.1016/j.jaad.2013.10.003 [PubMed: 24268311]
34. Zalaudek I, Giacomel J, Schmid K, et al. Dermoscopy of facial actinic keratosis, intraepidermal carcinoma, and invasive squamous cell carcinoma: a progression model. *J Am Acad Dermatol.* Apr; 2012 66(4):589–597. DOI: 10.1016/j.jaad.2011.02.011 [PubMed: 21839538]
35. Pan Y, Chamberlain AJ, Bailey M, Chong AH, Haskett M, Kelly JW. Dermoscopy aids in the diagnosis of the solitary red scaly patch or plaque-features distinguishing superficial basal cell carcinoma, intraepidermal carcinoma, and psoriasis. *J Am Acad Dermatol.* Aug; 2008 59(2):268–274. DOI: 10.1016/j.jaad.2008.05.013 [PubMed: 18550207]
36. Pehamberger H, Steiner A, Wolff K. In vivo epiluminescence microscopy of pigmented skin lesions. I. Pattern analysis of pigmented skin lesions. *J Am Acad Dermatol.* 1987; 17(4):571–583. [PubMed: 3668002]
37. Steiner A, Pehamberger H, Wolff K. In vivo epiluminescence microscopy of pigmented skin lesions. II. Diagnosis of small pigmented skin lesions and early detection of malignant melanoma. *J Am Acad Dermatol.* 1987; 17(4):584–591. [PubMed: 3668003]
38. Argenziano G, Soyer HP, Chimenti S, et al. Dermoscopy of pigmented skin lesions: results of a consensus meeting via the Internet. *J Am Acad Dermatol.* May; 2003 48(5):679–693. DOI: 10.1067/mjd.2003.281 [PubMed: 12734496]
39. Dummer R, Hauschild A, Lindenblatt N, Pentheroudakis G, Keilholz U. Cutaneous melanoma: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol.* Sep 1; 2015 26(suppl 5):v126–v132. DOI: 10.1093/annonc/mdv297 [PubMed: 26314774]
40. Marsden J, Newton-Bishop J, Burrows L, et al. Revised U.K. guidelines for the management of cutaneous melanoma 2010. *Br J Dermatol.* 2010; 163(2):238–256. DOI: 10.1111/j.1365-2133.2010.09883.x [PubMed: 20608932]
41. Garbe C, Peris K, Hauschild A, et al. Diagnosis and treatment of melanoma. European consensus-based interdisciplinary guideline - Update 2016. *Eur J Cancer.* Aug.2016 63:201–217. DOI: 10.1016/j.ejca.2016.05.005 [PubMed: 27367293]
42. Kittler H. The 2-Step Method and the Recognition Process in Dermoscopy. *JAMA Dermatol.* Sep; 2015 151(9):1037–1038. DOI: 10.1001/jamadermatol.2015.2000
43. Carrera C, Marchetti MA, Dusza SW, et al. Validity and Reliability of Dermoscopic Criteria Used to Differentiate Nevi From Melanoma: A Web-Based International Dermoscopy Society Study. *JAMA Dermatol.* Jul 1; 2016 152(7):798–806. DOI: 10.1001/jamadermatol.2016.0624 [PubMed: 27074267]

44. Argenziano G, Fabbrocini G, Carli P, De Giorgi V, Sammarco E, Delfino M. Epiluminescence microscopy for the diagnosis of doubtful melanocytic skin lesions. Comparison of the ABCD rule of dermoscopy and a new 7-point checklist based on pattern analysis. *Arch Dermatol.* Dec; 1998 134(12):1563–1570. [PubMed: 9875194]
45. Soyer HP, Argenziano G, Zalaudek I, et al. Three-point checklist of dermoscopy. A new screening method for early detection of melanoma. *Dermatology.* 2004; 208(1):27–31. DOI: 10.1159/000075042 [PubMed: 14730233]
46. Henning JS, Dusza SW, Wang SQ, et al. The CASH (color, architecture, symmetry, and homogeneity) algorithm for dermoscopy. *J Am Acad Dermatol.* Jan; 2007 56(1):45–52. DOI: 10.1016/j.jaad.2006.09.003 [PubMed: 17190620]
47. Stolz W, Riemann A, Cagnetta A, Pillet L. ABCD rule of dermoscopy: a new practical method for early recognition of malignant melanoma. *Eur J Dermatol.* 1994; (4):521–527.
48. Marghoob AA, Usatine RP, Jaimes N. Dermoscopy for the family physician. *Am Fam Physician.* Oct 1; 2013 88(7):441–450. [PubMed: 24134084]
49. Lallas A, Moscarella E, Longo C, et al. Likelihood of finding melanoma when removing a Spitzoid-looking lesion in patients aged 12 years or older. *J Am Acad Dermatol.* Jan; 2015 72(1): 47–53. DOI: 10.1016/j.jaad.2014.09.037 [PubMed: 25440960]
50. Argenziano G, Longo C, Cameron A, et al. Blue-black rule: a simple dermoscopic clue to recognize pigmented nodular melanoma. *Br J Dermatol.* Dec; 2011 165(6):1251–1255. DOI: 10.1111/j.1365-2133.2011.10621.x [PubMed: 21916885]
51. Zalaudek I, Kittler H, Hofmann-Wellenhof R, et al. “White” network in Spitz nevi and early melanomas lacking significant pigmentation. *J Am Acad Dermatol.* Jul; 2013 69(1):56–60. DOI: 10.1016/j.jaad.2012.12.974 [PubMed: 23415462]
52. Balagula Y, Braun R, Rabinovitz H, et al. The significance of crystalline/chrysalis structures in the diagnosis of melanocytic and nonmelanocytic lesions. *J Am Acad Dermatol.* 2012; 67(2): 194.e191–194.e198. DOI: 10.1016/j.jaad.2011.04.039 [PubMed: 22030020]
53. Pizzichetta MA, Talamini R, Marghoob AA, et al. Negative pigment network: an additional dermoscopic feature for the diagnosis of melanoma. *J Am Acad Dermatol.* Apr; 2013 68(4):552–559. DOI: 10.1016/j.jaad.2012.08.012 [PubMed: 23062610]
54. Rogers T, Marino ML, Dusza SW, et al. A Clinical Aid for Detecting Skin cancer: The Triage Amalgamated Dermoscopic Algorithm (TADA). *J Am Board Fam Med.* 2016; 29(6):694–701. DOI: 10.3122/jabfm.2016.06.160079 [PubMed: 28076252]
55. Argenziano G, Fabbrocini G, Carli P, De Giorgi V, Delfino M. Epiluminescence microscopy: criteria of cutaneous melanoma progression. *J Am Acad Dermatol.* Jul; 1997 37(1):68–74. [PubMed: 9216525]
56. Menzies SW, Kreusch J, Byth K, et al. Dermoscopic evaluation of amelanotic and hypomelanotic melanoma. *Arch Dermatol.* Sep; 2008 144(9):1120–1127. DOI: 10.1001/archderm.144.9.1120 [PubMed: 18794455]
57. Salopek TG, Kopf AW, Stefanato CM, Vossaert K, Silverman M, Yadav S. Differentiation of atypical moles (dysplastic nevi) from early melanomas by dermoscopy. *Dermatol Clin.* Apr; 2001 19(2):337–345. [PubMed: 11556242]
58. Soyer HP, Smolle J, Leitinger G, Rieger E, Kerl H. Diagnostic reliability of dermoscopic criteria for detecting malignant melanoma. *Dermatology.* 1995; 190(1):25–30. [PubMed: 7894091]
59. Annessi G, Bon R, Sampogna F, Faraggiana T, Abeni D. Sensitivity, specificity, and diagnostic accuracy of three dermoscopic algorithmic methods in the diagnosis of doubtful melanocytic lesions: the importance of light brown structureless areas in differentiating atypical melanocytic nevi from thin melanomas. *J Am Acad Dermatol.* 2007; 56(5):759–767. DOI: 10.1016/j.jaad.2007.01.014 [PubMed: 17316894]
60. Haenssle HA, Korpas B, Hansen-Hagge C, et al. Seven-point checklist for dermoscopy: performance during 10 years of prospective surveillance of patients at increased melanoma risk. *J Am Acad Dermatol.* May; 2010 62(5):785–793. DOI: 10.1016/j.jaad.2009.08.049 [PubMed: 20226567]

61. Menzies SW, Ingvar C, McCarthy WH. A sensitivity and specificity analysis of the surface microscopy features of invasive melanoma. *Melanoma Res.* 1996; 6(1):55–62. DOI: 10.1097/00008390-199602000-00008 [PubMed: 8640071]
62. Kenet RO, Kang S, Kenet BJ, Fitzpatrick TB, Sober AJ, Barnhill RL. Clinical diagnosis of pigmented lesions using digital epiluminescence microscopy. Grading protocol and atlas. *Arch Dermatol.* Feb; 1993 129(2):157–174. [PubMed: 8434973]
63. Bassoli S, Ferrari C, Borsari S, et al. Negative pigment network identifies a peculiar melanoma subtype and represents a clue to melanoma diagnosis: a dermoscopic study of 401 melanomas. *Acta Derm Venereol.* Nov; 2013 93(6):650–655. DOI: 10.2340/00015555-1588 [PubMed: 23695965]
64. Alon, S., Katrin, K., Harold, SR. *An Atlas of Dermoscopy.* 2. CRC Press; 2012. Histopathologic tissue correlations of dermoscopic structures; p. 10–32.
65. Saida T, Miyazaki A, Oguchi S, et al. Significance of dermoscopic patterns in detecting malignant melanoma on acral volar skin: results of a multicenter study in Japan. *Arch Dermatol.* Oct; 2004 140(10):1233–1238. DOI: 10.1001/archderm.140.10.1233 [PubMed: 15492186]
66. Lallas A, Apalla Z, Argenziano G, et al. The dermatoscopic universe of basal cell carcinoma. *Dermatol Pract Concept.* Jul; 2014 4(3):11–24. DOI: 10.5826/dpc.0403a02
67. Sakakibara A, Kamijima M, Shibata S, Yasue S, Kono M, Tomita Y. Dermoscopic evaluation of vascular structures of various skin tumors in Japanese patients. *J Dermatol.* Apr; 2010 37(4):316–322. DOI: 10.1111/j.1346-8138.2010.00828.x [PubMed: 20507400]
68. Micantonio T, Gulia A, Altobelli E, et al. Vascular patterns in basal cell carcinoma. *J Eur Acad Dermatol Venereol.* Mar; 2011 25(3):358–361. DOI: 10.1111/j.1468-3083.2010.03734.x [PubMed: 20561131]
69. Giacomel J, Zalaudek I. Dermoscopy of superficial basal cell carcinoma. *Dermatol Surg.* Dec; 2005 31(12):1710–1713. [PubMed: 16336893]
70. Huerta-Brogeras M, Olmos O, Borbujo J, et al. Validation of dermoscopy as a real-time noninvasive diagnostic imaging technique for actinic keratosis. *Arch Dermatol.* 2012; 148(10): 1159–1164. DOI: 10.1001/archdermatol.2012.1060 [PubMed: 23069952]
71. Fargnoli MC, Kostaki D, Piccioni A, Micantonio T, Peris K. Dermoscopy in the diagnosis and management of non-melanoma skin cancers. *Eur J Dermatol.* Jul-Aug; 2012 22(4):456–463. DOI: 10.1684/ejd.2012.1727 [PubMed: 22534287]
72. Cameron A, Rosendahl C, Tschandl P, Riedl E, Kittler H. Dermatoscopy of pigmented Bowen's disease. *J Am Acad Dermatol.* Apr; 2010 62(4):597–604. DOI: 10.1016/j.jaad.2009.06.008 [PubMed: 20079953]
73. Rosendahl C, Cameron A, Argenziano G, Zalaudek I, Tschandl P, Kittler H. Dermoscopy of squamous cell carcinoma and keratoacanthoma. *Arch Dermatol.* Dec; 2012 148(12):1386–1392. DOI: 10.1001/archdermatol.2012.2974 [PubMed: 22986634]
74. Cuellar F, Vilalta A, Puig S, Palou J, Salerni G, Malvehy J. New dermoscopic pattern in actinic keratosis and related conditions. *Arch Dermatol.* Jun. 2009 145(6):732. doi: 10.1001/archdermatol.2009.86 [PubMed: 19528439]
75. Argenziano G, Zalaudek I, Corona R, et al. Vascular structures in skin tumors: a dermoscopy study. *Arch Dermatol.* Dec; 2004 140(12):1485–1489. DOI: 10.1001/archderm.140.12.1485 [PubMed: 15611426]
76. Zalaudek II. How to diagnose nonpigmented skin tumors: a review of vascular structures seen with dermoscopy: part II. Nonmelanocytic skin tumors. *J Am Acad Dermatol.* 2010; 63(3):377–386. quiz 387–378. DOI: 10.1016/j.jaad.2009.11.697 [PubMed: 20708470]
77. Lallas A, Pyne J, Kyrgidis A, et al. The clinical and dermoscopic features of invasive cutaneous squamous cell carcinoma depend on the histopathological grade of differentiation. *Br J Dermatol.* 2015; 172(5):1308–1315. DOI: 10.1111/bjd.13510 [PubMed: 25363081]
78. Lin MJ, Pan Y, Jalilian C, Kelly JW. Dermoscopic characteristics of nodular squamous cell carcinoma and keratoacanthoma. *Dermatol Pract Concept.* Apr; 2014 4(2):9–15. DOI: 10.5826/dpc.0402a02 [PubMed: 24855567]

Key Points

- Dermoscopy increases diagnostic accuracy and sensitivity for melanoma, which translates into detection of thinner tumors.
- Multiple studies have established that dermoscopy is an aid for diagnosing basal cell carcinoma; the presence of dermoscopic criteria can predict the histopathological subtype of basal cell carcinoma.
- While actinic keratosis, Bowen's disease/squamous cell carcinoma in situ, invasive squamous cell carcinoma, and keratoacanthoma share common dermoscopic features, specific criteria can permit diagnostic discrimination.
- Dermoscopy novices can benefit from using diagnostic or triage algorithms to improve their diagnostic abilities and management decisions.

Fig. 1.

Dermoscopic features of melanoma. (A) Melanoma presenting with atypical globules and dots of different sizes and shapes (yellow arrows), patches of atypical network (blue arrowhead) and a blue-white veil (blue arrow). (B) Melanoma with diffuse polymorphous vasculature, consisting of serpentine, dotted, and glomerular vessels, can be found throughout the lesion (yellow arrowheads). In addition, patches of atypical network (blue arrowheads) are seen. (C) Superficial spreading melanoma with pseudopods distributed asymmetrically around the lesion (black arrowheads). (D) Melanoma with the regression structure blue-grey peppering (black star). Shiny white lines are also seen throughout the entire lesion (red arrows) along with a central blue-white veil (red arrowhead).

Fig. 2.

Dermoscopic features of melanoma in special locations. (A) Lentigo maligna melanoma on the face with concentric circles, also known as circle within a circle (blue arrowhead), grey circles (blue arrow), incomplete circles (black arrowhead), and angulated lines (black star). Within the melanoma, there is a seborrheic keratosis (black arrow) with comedo-like openings. (B) Melanoma of the nail matrix with brown lines that vary in thickness and have a disruption in parallelism. The patient has distal onycholysis. (C) Melanoma of the vulva with a linear pattern with features resembling a negative network (red asterisk). Yet, shiny white structures (red arrow) and multiple shades of brown with asymmetric distribution of pigment are indicative of melanoma. (D) Acral lentiginous melanoma on the volar skin of the heel with pigment on the ridges (red arrowheads).

Fig. 3.

Dermoscopic features of basal cell carcinoma. (A) Pigmented basal cell carcinoma with leaf-like structures (black arrow) and blue-grey ovoid nests, globules, and dots (blue arrows). (B) Nodular basal cell carcinoma with an arborizing vessel (yellow arrow) and blue-grey dots and globules (blue arrows). (C) Nonpigmented superficial basal cell carcinoma with shiny white blotches and strands (yellow arrowheads) and short fine vessels (blue arrowhead). (D) Superficial basal cell carcinoma with multiple erosions/ulcerations (white arrows) over an erythematous background with polymorphous vessels.

Fig. 4.

Dermoscopic features of keratinizing skin cancers. (A) Squamous cell carcinoma showing diffuse polymorphous vasculature consisting of numerous serpentine (black arrow), dotted (blue arrow), and looped vessels (yellow arrow). A triangular ulceration (yellow arrowhead) with associated scale (blue arrowhead) is also seen. (B) Keratoacanthoma presenting with a central keratin plug and a peripheral rim of irregular looped (red arrowheads) and serpentine vessels (black arrowhead). (C) Pigmented squamous cell carcinoma with numerous rosettes (white arrows). (D) Actinic keratosis with a strawberry pattern consisting of a structureless red area interrupted by the follicular openings.

Fig. 5.

Triage amalgamated dermoscopic algorithm (TADA) is a multistep process to guide dermoscopic management of skin lesions. First, unequivocal angiomas, dermatofibromas, and seborrheic keratoses are identified and excluded from further evaluation. Next the lesion is evaluated for the presence of architectural disorder or order. If architectural disorder is present, the lesion should be biopsied or referred for further management. On rare occasion a malignancy can present in an organized fashion, thus all organized lesions are then evaluated for blue-black or gray color, white structures, negative network, ulcer/erosion, starburst pattern and/or vessels. The presence of any one of these features would raise concern for malignancy. (*) Lesions of the volar surfaces, nails, mucosal surfaces, and face should not be evaluated with this algorithm.

Courtesy of Natalia Jaimes, MD, Miami, FL; Zachary J. Wolner, BA, Oriol Yelamos, MD, Konstantinos Liopyris, MD, Tova Rogers, MFA, Michael A. Marchetti, MD, Ashfaq A. Marghoob, MD, New York, NY.

Table 1

Dermoscopic features of melanoma

Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value	
			Sensitivity	Specificity
Atypical pigment network and angulated lines		<p><i>Atypical pigment network</i> has a disorganized and asymmetric distribution, areas of disruption, and/or significant variability in line thickness and color. In addition, the holes of the network are of differing sizes and shapes. An atypical network can appear “out of focus” with smudging of the network lines and/or with gray color.²⁶ An atypical network is associated with superficial spreading melanoma.⁵⁵</p> <p><i>Angulated lines</i> create a zigzag pattern with lines merging to create polygonal structures such as rhomboids. Angulated lines usually have a gray color and are associated with melanoma on sun damaged skin which includes lentigo maligna and lentigo maligna melanoma.³⁰</p>	21% ⁵⁶ ; 52%–77.1% ^{57–60} ; 100% ⁶¹	46% ⁶¹ ; 64.7%–88.5% ^{56–60,62}
				2.0–2.8 ^{18,43,56,60,938}
Negative network		<p><i>Negative network</i> consists of elongated and curvilinear globular structures that are surrounded by hypopigmentation. The hypopigmentation takes on the appearance of serpiginous lines meandering between the hyperpigmented elongated structures.²⁶ A negative network is associated with melanomas arising in nevi.⁶³</p>	22%–34.6% ^{53,61}	77.2%–95% ^{53,61}
				1.4 ⁴³ ; 1.8 ⁵³
Atypical dots/globules		<p><i>Dots and globules</i> consist of round to oval structures of differing size, color and distribution. In melanoma the dots tend to be black-brown in color, are not located on the lines of the network and are distributed in a disorganized fashion. Globules in melanoma tend to vary in color from blue-black to brown, have increased variability in size and shape and are distributed in a disorganized manner.²⁶</p>	13–39.6% ^{56,57,59,60}	74.3–92% ^{56,57,59,60}
				1.7–4.8 ^{38,56,57}

Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value	
			Sensitivity	4.8%–23% ^{56,59-61} 32% ⁵⁷ ; 58% ⁵⁸
Irregular streaks		<p><i>Streaks</i>, which encompass <i>pseudopods</i> and <i>radial streaming</i>, are linear projections located at the perimeter of the lesion that radiate from the tumor towards normal skin.²⁶ <i>Pseudopods</i> are linear projections with small knobs at their tips. <i>Radial streaming</i> are the same structures without the knobs. Streaks are a manifestation of radial growth and are associated with superficial spreading melanoma, especially when distributed focally at the periphery.^{26,61} Pseudopods appear to have a higher odds ratio than streaming.⁴³</p>	Specificity	62% ⁵⁸ ; 77% ⁵⁷ ; 90.2%–98.7% ^{56,59-62}
			Odds ratio	1.5–5.9 ^{38,43,56,57,60}
Regression structures		<p>Regression structures consist of nonpalpable areas revealing peppering/granularity and scar-like depigmentation. Peppering/granularity and scarlike depigmentation often occur together but can also present independently. <i>Peppering/granularity</i> consist of fine to coarse dots with a blue-grey color. <i>Scar-like depigmentation</i> consists of white areas that are lighter in color than the adjacent normal skin.²⁶ In areas of scarlike depigmentation, one will not see shiny white lines/crystalline structures or blood vessels.</p>	Sensitivity	11.4%–41.7% ^{56,57,59-61} ; 79% ⁵⁸
			Specificity	63% ⁵⁸ ; 83.5%–99% ^{56,57,59-61}
			Odds ratio	2–5.7 ^{38,43,60} ; 18.3 ⁵⁷
Blue-white veil		<p><i>Blue-white veil</i> consists of palpable areas having a blue-black color with an overlying whitish ground-glass haze.²⁶ The blue white veil corresponds with melanin/melanocytes in the dermis in association with compact orthokeratosis.⁶⁴</p>	Sensitivity	11.4%–28% ^{56,59,60} ; 51% ⁶¹ ; 92% ⁵⁸
			Specificity	74%–99.0% ^{56,58-62}
			Odds ratio	1.74–2.5 ^{43,57,60} ; 13 ³⁸
Shiny white lines		<p><i>Shiny white lines</i> (formerly known as <i>crystalline structures</i>) are only visible under polarized light and consist of short bright white line/s that, when in groups, often have a parallel or orthogonal orientation to each other. The presence of these structures is suggestive of melanoma or Spitz nevus and when present in melanoma are associated with invasion.^{52,61}</p>	Sensitivity	70.0% ⁵²
			Specificity	80.6% ⁵²
			Odds ratio	2.5 ⁴³ ; 9.7 ⁵²

Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value	
Atypical blotch		<p><i>Blotches</i> are an area of heavy pigmentation that obscures the ability to see any other structures in that area. <i>Atypical or irregular blotches</i> are defined as the presence of more than one blotch or the presence of an off center blotch located towards the periphery of the lesion.²⁶</p>	Sensitivity	18%–37.5% ^{56,57,59} ; 71.3% ⁶⁰
			Specificity	30.5% ⁶⁰ ; 88.2%–92.6% ^{56,57,59}
			Odds ratio	1.88–4.13 ^{8,43,56,60}
Polymorphous vessels		<p><i>Polymorphous vessels</i> are defined as multiple types of vessels in a single lesion.²⁶ Except for comma shaped vessels seen in intradermal nevi, any vessel or vascular blush (milky red areas) seen in a melanocytic lesion should raise concern for melanoma. Melanomas can reveal dotted vessels, serpentine vessels, tortuous vessels and milky red areas. The vascular structures with the strongest association with melanoma include multiple shades of pink and/or polymorphous vessels. The most predictive vasculature for melanoma is the combination of dotted and serpentine vessels.⁵⁶</p>	Sensitivity	9.4% ⁵⁹ ; 18% ⁶⁰ ; 62.9% ⁵⁶
			Specificity	53.8% ⁵⁶ ; 91.2% ⁶⁰ ; 96.1% ⁵⁹
			Odds ratio	2.0–3.04 ^{43,56,60}

Courtesy of Natalia Jaimes, MD, Miami, FL.

Table 2

Dermoscopic features of melanoma arising in special locations

	Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value		
				Sensitivity	-	
				Specificity	-	
				Odds ratio	3.82 ²¹	
Melanoma of the face	Blotches with obliteration of follicles		<i>Blotches with obliteration of follicles</i> are defined by the loss of visible adnexal openings forming the pseudonetwork typically seen in facial melanocytic tumors. ²¹ Blotches may be present with preservation of the follicle.			
	Concentric circles		<i>Concentric circles</i> (also known as circles within circles) are pigmented rings each surrounding an additional circle. ⁴³ The pigmented ring can be seen within the adnexal opening.	Sensitivity	4.2% ¹⁸	
				Specificity	98.8% ¹⁸	
				Odds ratio	2.0 ¹⁸	
	Grey circles		<i>Grey circles</i> are small rings that appear within follicular openings. ²¹	Sensitivity	54.2% ¹⁸	
				Specificity	83.3% ¹⁸	
				Odds ratio	2.86 ²¹ ; 4.6 ¹⁸	
	Asymmetric follicular opening (incomplete circles)		<i>Asymmetric follicular openings (incomplete circles)</i> are a pigment rings that do not uniformly surround an adnexal opening. ²⁶	Sensitivity	58.3% ¹⁸	
				Specificity	71.3% ¹⁸	
				Odds ratio	3.00 ¹⁸	

	Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value		
				Sensitivity	Specificity	Odds ratio
	Polygonal lines coalescing to form rhomboidal structures		<i>Polygonal lines coalescing to form rhomboidal structures typically surrounding adnexal openings.²¹</i>	16.7% ¹⁸	91.7% ¹⁸	2 ¹⁸ , 6.18 ²¹
Melanoma of the mucosa	Blue, gray, or white color and a structureless zone		<i>Structureless areas contain none of the basic elements such as dots, globules, circles, or lines. In addition, a lesion with a structureless zone that had blue, gray, or white color was most predictive of melanoma.²³</i>	100% ²³	82.2% ²³	-
Melanoma of volar surfaces	Parallel Ridge Pattern		<i>Parallel ridge pattern consists of thick lines of pigmentation on the ridges or cristae superficialis of volar skin.²⁶</i>	86.5% ⁶⁵	99.0% ⁶⁵	-
Melanoma of the nail apparatus	Irregular brown band		<i>Brown bands suggest melanocyte mediated pigmentation. Irregularity is present in the form of multiple colors (i.e. black, grey), varied thickness and spacing of lines, and loss of parallelism.²²</i>			

Courtesy of Natalia Jaimes, MD, Miami, FL.

Table 3

Classic features of basal cell carcinomas

Dermoscopic structures	Schematic illustration	Definition	Diagnostic Value		
			Sensitivity	10–17% ³⁰	
			Specificity	100% ³⁰	
			Odds ratio	-	
Spoke-wheel areas, concentric structures (clod within a clod) and leaflike areas		<i>Spoke-wheel areas</i> are brown to blue/gray well-circumscribed radial projections that originate from a central darker hub. ²⁶ If individual radial projections are not visible then this structure will appear as a concentric globular structure where the center of the globule will appear darker <i>Leaflike areas</i> , considered to be a similar structure to spoke wheel areas, are brown to blue/gray bulbous projections that coalesce into a darker off-center base. This structure often resembles the shape of a leaf. ²⁶	Sensitivity	27% ³⁰ , 55% ³⁰	
			Specificity	97% ³⁰ , 99% ³⁰	
			Odds ratio	-	
Multiple blue-grey nonaggregated dots and globules and large blue-grey ovoid nests		<i>Blue-grey dots</i> in basal cell carcinoma have a buck-shot distribution pattern. <i>Blue-grey globules</i> are well-circumscribed oval structures that are distributed in a nonaggregated pattern. ⁶⁶ <i>Blue-grey ovoid nests</i> are larger than globules and encompass at least 10% of the surface area of the lesion. They are well-circumscribed structures with a confluent to nearly confluent color. ^{26,66}	Sensitivity	20% ³⁵ , 52% ³⁰ , 72% ⁶⁷	
			Specificity	92–100% ^{30,35,67}	
			Odds ratio	6.7 ³⁵	
Arborizing (branched) vessels		Large caliber vessels that branch into thinner vessels. They are sharply in focus and bright-red in color. ²⁶	Sensitivity	20% ³⁵ , 52% ³⁰ , 72% ⁶⁷	
			Specificity	92–100% ^{30,35,67}	
			Odds ratio	6.7 ³⁵	

Dermoscopic structures	Schematic illustration	Definition	Diagnostic Value		
			Sensitivity	27% ³⁰	
			Specificity	97% ³⁰	
			Odds ratio	-	
Ulceration		A structureless area with a red-orange color that may have a serous crust. ⁶⁶ Smaller ulcers grouped together are known as multiple small erosions.			
Short fine vessels		Short (<1mm), thin, linear vessels with little to no branching points. ⁶⁶ These vessels are more frequently found in superficial basal cell carcinomas when compared to nodular basal cell carcinomas. ^{68,69}			
Shiny white blotches and strands		<i>Shiny white blotches and strands</i> appear shiny white under polarized light, a feature common across all shiny white structures. Unique to basal cell carcinoma are shiny white structures in the shape of blotches and strands. ^{26,32}			

Data from Menzies SW, Westerhoff K, Rabinovitz H, et al. Surface microscopy of pigmented basal cell carcinoma. *Arch Dermatol.* Aug 2000;136(8):1012–1016.

Courtesy of Natalia Jaimes, MD, Miami, FL.

Table 4

Actinic keratoses

Pigmented Tumors			
Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value
Strawberry Pattern		<i>Strawberry pattern</i> is a red pseudonetwork (background erythema and fine wavy vessels) punctuated by adnexal openings accentuated by a white halo. ²⁶ A study comparing actinic keratoses to lentigo maligna demonstrated the preservation of follicle integrity is 12.45 times more likely of being pigmented actinic keratosis. ²¹	Sensitivity 95.6% ⁷⁰
			Specificity 95.0% ⁷⁰
			Odds ratio 3.6; 13.52 ²¹
Surface Scale		<i>Surface scale</i> consists of homogenous opaque adherently keratotic structures with yellowish to brown or white coloration. ^{70,71} It is a common feature of actinic keratosis and squamous cell carcinoma. ³⁴	Sensitivity 93.7% ⁷⁰ ; 37.7% ¹⁸
			Specificity 35% ⁷⁰ ; 94.2% ¹⁸
			Odds ratio 7.67 ²¹ ; 3.4 (RR) ¹⁸

Courtesy of Natalia Jaimes, MD, Miami, FL.

Table 5

Intraepidermal carcinoma and squamous cell carcinoma

Pigmented Tumors			
Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value
Globules/Dots or Round circles		<i>Globules/dots or Round circles</i> are brown to gray structures that, when arranged in a linear fashion, were frequently found in pigmented intraepidermal carcinoma. ⁷²	
Nonpigmented Tumors			
Ulceration		<i>Ulceration</i> includes large structureless area with dark red to brown coloration with a serous crust. Classically attributed and identified in squamous cell carcinoma, but no studies have determined sensitivity or specificity. ^{34,71} "Blood spots" have been identified as independent positive predictors of keratoacanthomas and squamous cell carcinomas, yet an association with ulceration remains unevaluated. ⁷³	
Rosettes		<i>Rosettes</i> consist of four bright white clods or dots arranged in a 2 by 2 pattern, also called a 4- leaf clover pattern. This structure can only be seen with polarized light and corresponds to keratin filled adnexal openings that are most commonly seen in actinically damaged skin, actinic keratosis and squamous cell carcinoma. ^{26,32,74}	
Glomerular Vessels		<i>Glomerular or coiled vessels</i> are often seen in squamous cell carcinoma. ^{26,75} The presence of clustering of glomerular, dotted and irregular vessels is highly associated with intraepidermal carcinoma. ³⁵	Sensitivity
			60% ³⁵ ; 27% ⁶⁷
			Specificity
			94% ³⁵ ; 100% ⁶⁷
			Odds ratio
			21.9 ³⁵

Pigmented Tumors				
Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value	
Polymorphous vasculature		<i>Polymorphous vasculature</i> is an array of multiple (looped, dotted, and/or serpentine) vessels distributed irregularly throughout the lesion. ²⁶ Classically this pattern is associated with squamous cell carcinoma but no studies have evaluated sensitivity/specificity of the polymorphous pattern. ^{34,76} Increasing vascularity, higher vessels caliber, and visible bleeding were significantly associated with poorly differentiated squamous cell carcinoma. ⁷⁷		

Courtesy of Natalia Jaimes, MD, Miami, FL.

Table 6

Keratoacanthoma and/or well differentiated squamous cell carcinoma

Dermoscopic structures	Schematic illustration	Definition/Significance	Diagnostic Value	
White Circles		<i>White circles</i> are bright white circles surrounding a dilated infundibulum filled with a yellow/orange keratin plug. ⁷³ This structure is associated with well differentiated squamous cell carcinoma and often seen in keratoacanthomas. ⁷³	Sensitivity	31.9% ¹⁸
			Specificity	94.2% ¹⁸
			Odds ratio	3.0 (RR) ¹⁸
Looped Vessels		<i>Looped vessels</i> are vascular loops, that depending on the dermoscopy user's angle of view, can appear twisted. ²⁶ Looped vessels have been observed in higher frequencies in nodular squamous cell carcinoma and keratoacanthomas. ^{34,73,78}		

Courtesy of Natalia Jaimes, MD, Miami, FL.