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Onychoscopy

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Abstract Dermatoscopy can be used to evaluate the nail apparatus (ie, onychoscopy), and it is helpful for the diagnosis of numerous nail diseases and tumors. This article reviews the information that can be obtained in cases of nail dyschromia and especially in cases of melanonychia, in which the distinction between benign melanocytic activation or proliferation and malignancy is crucial. Dermatoscopic changes that accompany specific nail diseases are also reviewed, such as those observed with subungual hemorrhage, bacterial and fungal nail infections, psoriasis of the nail, lichen planus of the nail, and vascular abnormalities of the nail fold.

Introduction

Dermatoscopy can be used to evaluate various parts of the nail apparatus, including the nail plate surface and the free edge, the nail matrix, the nail bed, the periungual folds, and the hyponychium. Several studies have shown that dematoscopy is helpful for the diagnosis of numerous nail diseases.[1,2]

Methods of nail dermatoscopy

Direct contact nonpolarized dermatoscopy of the nail plate (ie, onychoscopy) requires an immersion gel such as ultrasound gel.[3,4] Alternatively, alcohol can be used for the examination of the free edge.[5] Alcohol is preferred as the interface solution for the observation of the skin and capillaries of the hyponychium, which requires the high magnification of a videodermatoscope.[6] Observation of the capillaries of the proximal nail fold can be done with polarized dermatoscopy. In our opinion, the best quality is obtained during oil or gel immersion with either a video dermatoscope or a handheld device.[7,8]

When evaluating melanonychia, the clinician should bear in mind that, as opposed to skin dermatoscopy, nail dermatoscopy visualizes the site of nail plate melanin deposition and not its origin (ie, the nail matrix or the nail bed); therefore, pigment distribution observed in the nail plate may not accurately represent the features of the underlying lesion.

Intraoperative nail matrix and bed dermatoscopy, with reflection of the proximal nail fold and partial or complete avulsion of the nail plate, allows for the direct visualization of the site of production of pigment.[1,9] In this setting, a polarized light dermatoscope may be used to avoid contact with potentially contaminated blood and tissue.[2,9,10]

Melanonychia

The term *melanonychia* refers to pigmentation of the nail plate that is caused by the presence of melanin.[1] When

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considering a pigment band, the physician should follow a four-step algorithm.[11] First, he or she should establish if the pigment is melanin, with blood being the most important differential.[12] The next step will be establishing if the melanin deposition is secondary to melanocyte activation or melanocyte proliferation.[1,13] Third, in the case of proliferation, the physician should establish whether the lesion is benign (eg, lentigo, nevus) or malignant. Although some authors believe in the role of dermatoscopy for differentiating benign from malignant melanocytic hyperplasia, our experience has shown that dermatoscopy is not effective for increasing dermatological accuracy with regard to the diagnosis of melanoma.[14]

The following criteria have been proposed to be used during the dermatoscopic evaluation of melanonychia[13,15,16]:

- Blood is recognized by its round globules and filamentous distal end.
- The color of the band indicates whether it is caused by activation (gray bands) or proliferation (brown–black bands). Bands that are caused by activation are benign and do not require pathological evaluation.[17]
  - o *Brown–black bands with a regular pattern:* Individual lines that have similar shades of color, that are of a similar thickness, that are regularly spaced, and that are parallel are a sign of benign proliferation.[18]
  - o *Brown–black bands with an irregular pattern:* Lines that vary in color (and not only in shades of the same color), that are irregularly spaced, that have different thicknesses, and that may lose their parallelism and cross each other are suggestive of malignant proliferation and should be excised.[18]

  In our experience, these criteria are not valid for children, in whom benign lesions often have an irregular pattern.[1] The criteria are also often difficult to apply to adult patients.[14]
- The micro-Hutchinson sign (ie, pigmentation of the cuticle that is only observable through dermatoscopy and not clinically) can be visualized by dermatoscopy and is indicative of malignancy.[1]
- Melanin granular inclusions (<0.1 mm in diameter; may be more adequately seen under high magnification) are seen in cases of melanocyte proliferation.[15]

Dermatoscopy of the free edge of the nail plate can assess whether the origin of the nail plate pigment lies on the proximal or distal nail matrix. If the pigment is located on the upper portion of the free edge, then it is produced in the proximal matrix; if it is in the lower portion, its origin lies on the distal matrix (as is more commonly observed).[1,5] If doubt persists, a nail clipping and Fontana-Mason staining may be used.[5,15]

In a review of 100 cases of longitudinal melanonychia with intraoperative nail dermatoscopy, the following patterns were noted[2]:

- A gray pattern is suggestive of melanocytic activation.
- A regular brown pattern is suggestive of benign melanocytic hyperplasia, although it is also observable in some cases of melanoma.[19]
- A regular brown pattern with globules and blotches is suggestive of melanocytic nevi.
- An irregular pattern is suggestive of melanoma.

These patterns may not be easy to distinguish; thus, practice and experience with nail dermatoscopy and intraoperative nail dermatoscopy are very important.[14,20]

Nail dermatoscopy should always be only a part of the evaluation and does not replace a good clinical history and examination, which includes addressing the ABCDEFs of pigmented nail lesions (ie, patient Age, Band color and breadth, history of Change, Digit involved, Extension to nail fold, and Family or personal history).[21]

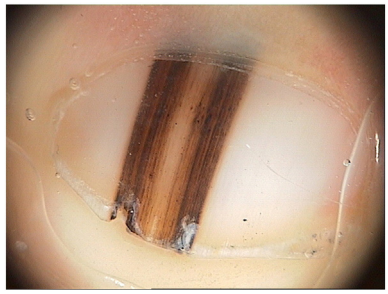

Fig. 1 Melanoma of the nail. Note the dark brown band with irregular lines. The proximal part is wider than the distal part. There are also nail plate abnormalities and melanin granules. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this contribution.)

Nail apparatus melanoma

Prominent dermatoscopic features of melanoma are brown discoloration of the background with longitudinal brown to black lines that are irregular in color, spacing, and thickness and that demonstrate a loss of parallelism (Figure 1)[13]; however, it is possible to find subungual melanoma with either a regular pattern or a thin band of light brown pigment (ie, <3 mm).[14,15] It is very common for nevi in children to present with brown–black bands with an irregular pattern.[1]

Irregularity, crisscrossing, the abrupt stoppage of lines, and the micro-Hutchinson sign favor a diagnosis of melanoma.[13,22,23] In rapidly growing melanomas, the proximal end of the band may be wider than the distal portion.[15] Blood spots may be observed in cases of melanoma; hence, their presence does not rule out the diagnosis.[13]

When evaluating for the presence of the micro-Hutchinson sign, special care must be taken to not confuse the appearance of nail plate pigmentation under the relatively translucent cuticle (ie, the pseudo-Hutchinson sign) with that of pigmentation of the cuticle and the proximal nail fold. An additional feature of melanoma may be erosion or microscopic grooves of the nail plate surface, but these have not demonstrated a statistically strong correlation with this diagnosis.[13,18]

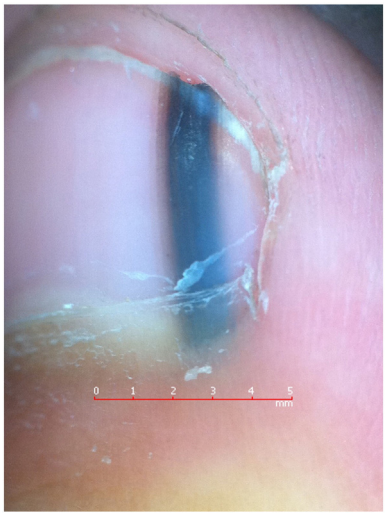

Fig. 2 Nevus of the nail. A black band is visible through the cuticle; this is pseudo-Hutchinson sign. The lines are not visible, because the band is very dark. The lesion shown here was excised.

Amelanotic melanoma is always a challenging diagnosis. When the nail is partial or totally destroyed by nonpigmented reddish tumors, dermatoscopy may identify remnants of pigmentation, thereby allowing for a differential diagnosis that involves pyogenic granuloma and other nonmelanocytic nail tumors.[1,18] A polymorphic vascular pattern with combinations of milky-red areas and red spots may be observed in these cases.[19]

Melanocytic nevus

Features of the diagnosis of melanocytic nevus include brown discoloration of the background with lines that are regular with regard to pattern, coloration, width, spacing, and parallelism (Figure 2).[12,22,23] Nevi may be responsible for strikingly black pigmentation of the nail plate, thereby making the observation of line pattern difficult and the differential diagnosis of melanoma even harder to make.[18] In addition, a clinical Hutchinson sign, longitudinal melanonychia with a broader proximal end, darkening and spreading of the band, and thinning and grooving of the nail plate are not uncommon features of congenital nevi in children.[1]

The hyponychial Hutchinson sign may display a benign parallel furrow pattern that is suggestive of nevus; alternatively, it may display either an irregular ridge pattern or a haphazard surface pigmentation, both of which are suggestive of melanoma.[23] These features are analogous to those that are found when evaluating pigmented acral skin lesions, and they are perhaps useful for distinguishing a benign from a malignant Hutchinson sign, in addition to all other characteristics that are observable through nail dermatoscopy.

A subungual blue nevus may be responsible for blue discoloration of the nail plate.[24]

Nonmelanocytic nail tumors

Tumors that either lie within or close to the nail apparatus may cause melanonychia as a result of melanocyte activation. Examples include epidermal inclusion cysts,[22] onychopapilloma (Figure 3, A and B),[25] and Bowen's disease.[26]

Melanocyte activation

Clinically, a diagnosis of melanocyte activation may be already suggested by the presence of pale bands and by the involvement of several nails. A grayish coloration of the background with regular gray lines is typical (Figure 4).[13,22]

With regard to pigmentation related to repetitive trauma (eg, onychotillomania, onychophagia, frictional melanonychia of the fourth and fifth toenails), dermatoscopy shows homogeneous gray pigmentation and tiny dark red to brown spots that represent blood extravasation.[1,18]

Subungual hemorrhage

Subungual hemorrhage may be an important differential diagnosis of melanoma of the nail when a longitudinal

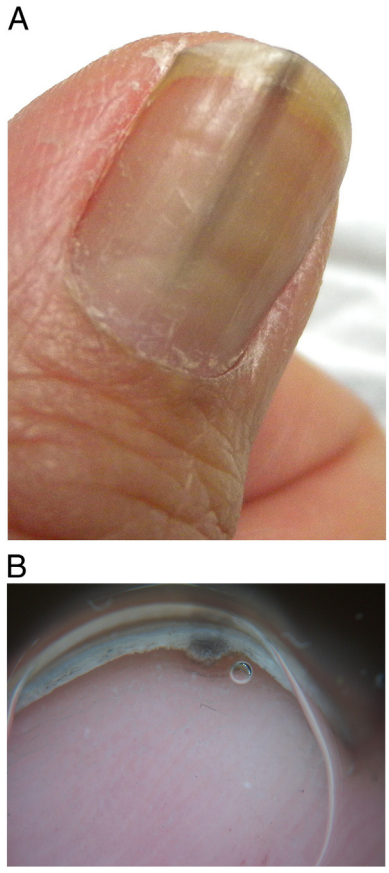

Fig. 3 A, Melanonychia caused by onychopapilloma. B, Onychopapilloma. Dermatoscopy of the free edge of the nail allows for the clinical diagnosis.

disposition of the hemorrhage is observed. The blood spot pattern is, nonetheless, characterized by black, purple, and reddish to brown coloration; a well limited, rounded, proximal edge; and a sometimes streaked and filamentous distal end.[1,13,15,18] A few similarly colored blood globules may be seen in the vicinity of the hemorrhage.

An isolated report coined the term *pseudopods* to refer to the distal end of a nail hemorrhage; in our opinion, this is equivalent to the streaked distal end described previously.[27] Although this pattern has a strong association with subungual hemorrhage, its presence should not be used to rule out melanoma.[1,13] Bleeding within this tumor may account for such a phenomenon in the setting of melanoma.[15] A history of trauma to the digit has been mentioned in the context of nail unit melanoma, which adds another potential confounding factor.[28,29]

It may be prudent to follow up suspected nail hemorrhaging 3 to 4 months later to assess its movement toward the distal end as well as its proximal clearance.[18] The lesion should be considered suspicious if the hemorrhage does not progress or if it reappears at the same place.[12]

Fungal and bacterial nail infection

Some bacteria and fungi may be responsible for the brown–black discoloration of the nail plate. The absence of granular inclusions and the presence of other suggestive signs should elicit the cause.[15] *Pseudomonas* colonization can cause a longitudinal green discoloration (Figure 5, A and B).

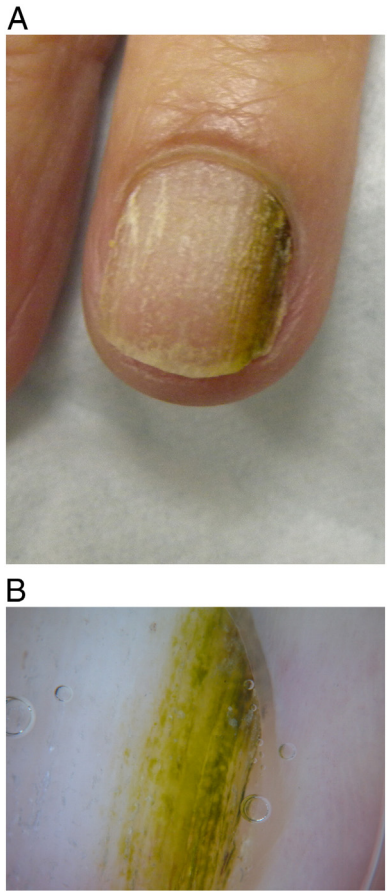

Fig. 5 A, A longitudinal green line caused by *Pseudomonas* colonization. B, Pseudomonal nail infection. Dermatoscopy shows pigment deposition within the nail plate.

Dermatoscopy for other causes of chromonychia

Although there is a wealth of knowledge regarding the potential causes of nail dyschromia, we have found very few reports about the use of dermatoscopy for leukonychia, erythronychia, or yellow, blue, or green chromonychia. The authors' conclusions are addressed in the following sections.

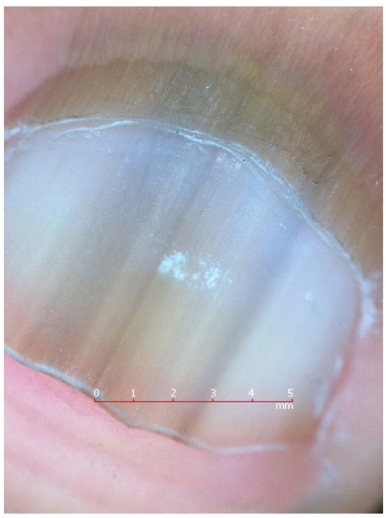

Fig. 4 Melanocyte activation. Note the regular gray bands.

Longitudinal leukonychia

Dermatoscopy provides the optimal evaluation of leukonychia and allows for easy distinction between true leukonychia and pseudoleukonychia (Figure 6). In a case of onychopapilloma, dermatoscopy highlighted the appearance of a longitudinal white ridge; the white chromonychia was already clinically evident.[30]

In a case of onychomatricoma in a child, the use of dermatoscopy also highlighted the presence of white longitudinal lines (which corresponded to nail plate canals) and splinter hemorrhages.[31] The dermatoscopic features of thumbnail dystrophy in three patients with Hailey-Hailey disease were multiple parallel longitudinal white lines of variable width with distal microscopic grooves and splinter hemorrhages.[32]

Erythronychia

Dermatoscopy is very useful for the evaluation of erythronychia. It allows for the very fast diagnosis of

Fig. 6 Pseudoleukonychia caused by a shellac manicure. Note the superficial desquamation of the nail plate.

onychopapilloma, which is the most common cause of longitudinal red discoloration. Only one case report demonstrated the use of nail plate dermatoscopy to visualize erythronychia caused by a glomus tumor. Intraoperative nail bed and matrix dermatoscopy was then used to guide excision.[33]

Onychomycosis

Dermatoscopic features of onychomycosis have recently been described,[34] and two characteristics are considered sensitive and specific to the diagnosis. During the analysis of the proximal margin of the onycholysis, a jagged edge is seen, and sharp longitudinal whitish indentations are seen that correspond with the proximal progression of the fungi. The other sign is the presence of longitudinal striae with irregular matted pigmentation of different colors (ie, white, yellow, orange, and brown) that can be seen at the onycholytic area (Figure 7). Other features include black dots and yellow–orange homogenous colors of the affected nail plate, although these are not considered specific.

Traumatic onycholysis

The specific sign of traumatic onycholysis is the presence of a linear edge in the proximal margin of the onycholysis, without spikes (Figure 8).[34]

Psoriasis of the nail

Psoriasis can be limited to the nail. Some important diagnostic features, such as pitting and salmon patches, can be better visualized with the help of handheld and video dermatoscopy. These changes can help distinguish localized psoriasis of the nail from idiopathic onycholysis, nail bed lichen planus, and onychomycosis. Splinter hemorrhages are also very common although nonspecific, because they can also be found in cases of onychomycosis, trauma, and contact dermatitis. They appear as thin, longitudinal lines, and they are a sign of capillary bleeding.[35]

Dermatoscopy of the hyponychium is very useful for the diagnosis of psoriasis of the nail. Hyponychial capillaries are dilated, tortuous, and elongated, with irregular distribution; they correlate with disease severity and response to treatment.[6] These capillary loops are seen as regular red dots at low magnification with hand dermatoscopy.[6] The number and diameter of capillaries are decreased on the proximal nail folds of patients with psoriasis with associated nail changes.[36] Proximal nail fold dermatoscopy can also

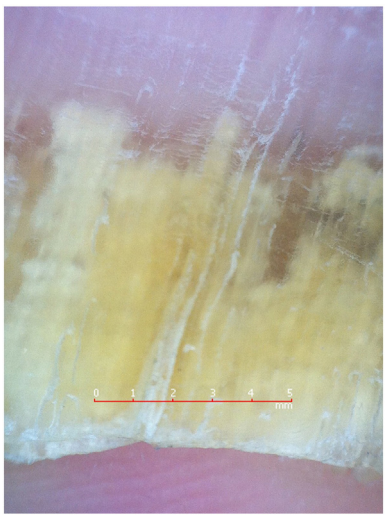

Fig. 7 Onychomycosis. Note the spiked appearance of the proximal margin of onycholysis.

Fig. 8 Traumatic onycholysis. Note the linear shape of the proximal border.

measure disease severity.[35,36] Some authors consider dermatoscopy to be the best tool for the diagnosis of psoriasis in patients with isolated onycholysis.[37]

Lichen planus of the nail

In some cases, it can be very difficult to distinguish isolated lichen planus of the nail bed from isolated psoriasis of the nail. In these cases, dermatoscopy can help with the diagnosis. With psoriasis, numerous tortuous capillaries are seen in the hyponychium and the proximal nail fold; with lichen planus, no capillaroscopic changes are seen.[38]

Nail fold capillaroscopy

Recently, dermatoscopy has been used to study nail fold vascular abnormalities, and it shows most of the findings that can be observed with video capillaroscopy.[37] Nail fold capillaroscopy can be divided into three patterns: a normal pattern, a scleroderma pattern, and a nonspecific pattern. Homogeneous capillary distribution without morphologic changes is the main feature of the normal pattern.[39]

The scleroderma pattern, which is seen in patients with systemic sclerosis, can be found in patients with other connective tissue diseases (eg, dermatomyositis). This pattern is characterized by at least two of the following features: irregularly enlarged capillaries; giant capillaries; hemorrhages; a reduced capillary number with avascular areas; and tortuous, crossed, and arborized capillaries.[39–41]

In patients with primary Raynaud phenomenon, capillaroscopy is normal. Instead, capillaroscopic alterations are observed in those with Raynaud phenomenon and an associated connective tissue disease.[40]

References

1. Tosti A, Piraccini B, de Farias D. Dealing with melanonychia. *Semin Cutan Med Surg.* 2009;28:49-54.
2. Hirata S, Yamada S, Enokihara M, et al. Patterns of nail matrix and bed of longitudinal melanonychia by intraoperative dermatoscopy. *J Am Acad Dermatol.* 2011;65:297-303.
3. Gewirtzman A, Saurat J, Braun R. An evaluation of dermatoscopy fluids and application techniques. *Br J Dermatol.* 2003;149:59-63.
4. Tasli L, Oquz O. The role of various immersion liquids at digital dermatoscopy in structural analysis. *Indian J Dermatol Venereol Leprol.* 2011;77:110.
5. Braun R, Baran R, Saurat J, et al. Surgical pearl: dermatoscopy of the free edge of the nail to determine the level of nail plate pigmentation and the location of its probable origin in the proximal or distal nail matrix. *J Am Acad Dermatol.* 2006;55:512-513.
6. Iorizzo M, Dahdah M, Vicenzi C, et al. Videodermatoscopy of the hyponychium in nail bed psoriasis. *J Am Acad Dermatol.* 2008;58: 714-715.
7. Bergman R, Sharony L, Schapira D, et al. The handheld dermatoscope as a nail-fold capillaroscopic instrument. *Arch Dermatol.* 2003;139: 1027-1030.
8. Park J, Lee D, Cha H, et al. Handheld portable digital dermatoscopy: routine outpatient use for evaluating nail-fold capillary changes in autoimmune connective tissue diseases. *J Eur Acad Dermatol Venereol.* 2009;23:207.
9. Hirata S, Yamada S, Almeida F, et al. Dermatoscopy of the nail bed and matrix to assess melanonychia striata. *J Am Acad Dermatol.* 2005;53: 884-886.
10. Hirata S, Yamada S, Almeida FA, et al. Dermoscopic examination of the nail bed and matrix. *Int J Dermatol.* 2006;45:28-30.
11. Tosti A, Argenziano G. Dermatoscopy allows better management of nail pigmentation. *Arch Dermatol.* 2002;138:1369-1370.
12. Braun R, Oliviero M, Kolm I, et al. Dermatoscopy: what's new? *Clin Dermatol.* 2009;27:26-34.
13. Ronger S, Touzet S, Ligeron C, et al. Dermoscopic examination of nail pigmentation. *Arch Dermatol.* 2002;138:1327-1333.
14. Di Chiacchio N, Hirata S, Enokihara M, et al. Dermatologists' accuracy in early diagnosis of melanoma of the nail matrix. *Arch Dermatol.* 2010;146:382-387.
15. Braun R, Baran R, Le Gal F, et al. Diagnosis and management of nail pigmentations. *J Am Acad Dermatol.* 2007;56:835-847.
16. Thomas L, Ronger S. Dermatoscopy of nail pigmentation. In: Baran R, Dawber R, Haneke R, Tosti A, Bristow I, eds. *A Text Atlas of Nail Disorders—Techniques in Investigation and Diagnosis* [Internet]. 3rd ed. London: Taylor & Francis e-Library; 2003. p. 302-311.
17. Husain S, Scher R, Silvers D, et al. Melanotic macule of nail unit and its clinicopathologic spectrum. *J Am Acad Dermatol.* 2006;54:664-667.
18. Thomas L, Dalle S. Dermatoscopy provides useful information for the management of melanonychia striata. *Dermatol Ther.* 2007;20:3-10.
19. Phan A, Dalle S, Touzet S, et al. Dermoscopic features of acral lentiginous melanoma in a large series of 110 cases in white population. *Br J Dermatol.* 2010;162:765-771.
20. Koga H, Saida T, Uhara H. Key point in dermoscopic differentiation between early nail apparatus melanoma and benign longitudinal melanonychia. *J Dermatol.* 2011;38:45-52.
21. Levit E, Kage M, Scher R, et al. The ABC rule for clinical detection of subungual melanoma. *J Am Acad Dermatol.* 2000;42:(2 Pt 1):269-274.
22. John R, Izakovic J. Dermatoscopy/ELM for the evaluation of nail-apparatus pigmentation. *Dermatol Surg.* 2011;27:315-322.
23. Kawabata Y, Ohara K, Hino H, et al. Two kinds of Hutchinson's sign, benign and malignant. *J Am Acad Dermatol.* 2001;44:305-307.
24. Causeret A, Skowron F, Viallard A, et al. Subungual blue nevus. *J Am Acad Dermatol.* 2003;49:310-312.
25. Miteva M, Fanti P, Romanelli P, et al. Onychopapilloma presenting as longitudinal melanonychia. *J Am Acad Dermatol.* 2012;66:242-243.
26. Lambiase M, Gardner T, Altman C, et al. Bowen disease of the nail bed presenting as longitudinal melanonychia: detection of human papillomavirus type 56 DNA. *Cutis.* 2003;72:305-309.
27. Haas N, Henz B. Pitfall in pigmentation: pseudopods in the nail plate. *Dermatol Surg.* 2002;28:966-967.
28. Grazzini M, Rossari S, Gori A, et al. Subungueal pigmented lesions: warning for dermoscopic melanoma diagnosis. *Eur J Dermatol.* 2011; 21:286-287.
29. Phan A, Touzet S, Dalle S, et al. Acral lentiginous melanoma: a clinicoprognostic study of 126 cases. *Br J Dermatol.* 2006;155:561-569.
30. Criscione V, Telang G, Jellinek N. Onychopapilloma presenting as longitudinal leukonychia. *J Am Acad Dermatol.* 2010;63:541-542.
31. Piraccini B, Antonucci A, Rech G, et al. Onychomatricoma: first description in a child. *Pediatr Dermatol.* 2007;24:46-48.
32. Bel B, Jeudy G, Vabres P. Dermatoscopy of longitudinal leukonychia in Hailey-Hailey disease. *Arch Dermatol.* 2010;146:1204.
33. Maehara Lde S, Ohe E, Enokihara M, et al. Diagnosis of glomus tumor by nail bed and matrix dermatoscopy. *An Bras Dermatol.* 2010;85:236-238.
34. Piraccini B, Balestri R, Starace M, Rech G. Nail digital dermatoscopy (onychoscopy) in the diagnosis of onychomycosis. *J Eur Acad Dermatol Venereol.* 2013;27:509-513.
35. Farias D, Tosti A, Chiacchio N, et al. Dermatoscopy in nail psoriasis. *An Bras Dermatol.* 2010;85:101-103.

36. Bhushan M, Moore T, Herrick A, et al. Nailfold video capillaroscopy in psoriasis. *Br J Dermatol.* 2000;142:1171-1176.
37. Tosti A, Piraccini B, de Farias D. Nail diseases. Dermatoscopy in Clinical Practice: Beyond Pigmented Lesions. London: Informa Healthcare Ltd; 2010.
38. Vázquez-López F, Manjón-Haces J, Maldonado-Seral C, et al. Dermoscopic features of plaque psoriasis and lichen planus: new observations. *Dermatology.* 2003;207:151-156.
39. Hasegawa M. Dermatoscopy findings of nail fold capillaries in connective tissue diseases. *J Dermatol.* 2011;38:66-70.
40. Beltrán E, Toll A, Pros A, et al. Assessment of nailfold capillaroscopy by x 30 digital epiluminescence (dermatoscopy) in patients with Raynaud phenomenon. *Br J Dermatol.* 2007;156:892-898.
41. Gallucci F, Russo R, Buono R, et al. Indications and results of videocapillaroscopy in clinical practice. *Adv Med Sci.* 2008;53: 149-157.