Conventional and Polarized Dermoscopy Features of Dermatofibroma

Anna Liza C. Agero, MD; Salvatore Taliercio; Stephen W. Dusza, MPH; Cristina Salaro, MD; Paul Chu, MD; Ashfaq A. Marghoob, MD

Objective: To evaluate dermoscopic features and patterns of dermatofibromas using conventional and polarized light dermoscopy.

Design: Dermatofibromas were imaged using conventional nonpolarized contact dermoscopy (NPD), polarized contact dermoscopy (PCD), and polarized noncontact dermoscopy, followed by evaluation and comparison of dermoscopic features of the lesions.

Setting: Dermatology clinic specializing in pigmented lesions.

Patients: Fifty patients with dermatofibromas.

Results: The most common features of dermatofibromas observed with NPD and PCD were central white scarlike patches (37 [74%] and 42 [84%], respectively), brown globulelike structures (21 [42%] and 22 [44%]), vascular structures (24 [48%] and 22 [44%]), and a peripheral fine pigmented network (36 [72%] for both). A newly described feature observed with PCD was a central white patch characterized by shiny white streaks. With polarized noncontact dermoscopy, the most characteristic feature was a central pink hue or "vascular blush" (44 [88%]) and visibility of blood vessels (41 [82%]). The most common pattern identified with NPD and PCD was the combination of a peripheral pigmented network and a central white patch in 28 (56%) and 31 (62%) of lesions, respectively. With polarized noncontact dermoscopy, the most common pattern was a central pink hue with a peripheral pigmented network (23 [46%]). There was good to excellent agreement when comparing NPD with PCD images, but there was a variable level of agreement when polarized noncontact dermoscopy images were compared with NPD and PCD images.

Conclusions: Conventional and polarized light dermoscopy are not equivalent but may be complementary. This study highlights some salient differences. We were able to identify new dermoscopic features and patterns not previously described with conventional dermoscopy. These new criteria can aid in the diagnosis of dermatofibroma.

Arch Dermatol. 2006;142:1431-1437

Dermatofibromas (DFs) are common benign skin lesions that are easily diagnosed clinically in most cases; occasionally, however, accurate clinical differentiation of DFs from other lesions, such as dysplastic nevi or malignant melanoma, is a challenge. In these cases, dermoscopy may be useful in verifying the clinical diagnosis of DF. Dermoscopic characteristics of DFs have previously been described, including stereotypical findings such as a central white scarlike patch surrounded by a delicate pigmented network at the periphery.1-3 Most articles on dermoscopy report the use of conventional contact (fluid immersion) dermoscopy, inasmuch as this technique is the current standard, with the handheld monocular immersion dermoscope in widespread use. However, new commercially available dermoscopes enable contact or noncontact dermoscopy with cross polarization.4,5 We have observed some differences when comparing images of pigmented lesions obtained with contact nonpolarized dermoscopy (NPD), polarized contact dermoscopy (PCD), and polarized noncontact dermoscopy (PNCD).6 This raises the issue of the applicability of previously known and reported dermoscopic features when evaluating lesions with polarized light dermoscopy.

This study evaluates and compares the dermoscopic features and patterns of DF lesions using these 3 dermoscopic techniques. To our knowledge, this is the first formal descriptive study using polarized light dermoscopy and nonpolarized light dermoscopy concurrently in the evaluation of DF lesions.
METHODS

Fifty patients with DF were included in the study. All patients had clinically stable lesions with at least 1 year of follow-up. Biopsy specimens of DF lesions that appeared clinically atypical were later obtained for histopathologic confirmation. Patients were recruited from the Pigmented Lesion Clinic at the Memorial Sloan-Kettering Cancer Center satellite facility in Hauppauge, NY. After obtaining oral consent from the patients, close-up clinical images of all DF lesions were obtained, followed by dermoscopy using the 3 methods, as described later: NPD, PCD, and PNCD. All photographs were taken with a digital camera (Nikon CoolPix 4500; Nikon Inc, Melville, NY). The camera was white color-balanced, and all images were obtained in program mode under a fixed magnification using automatic focus.

The dermoscopes used to capture images were provided by 3Gen LLC, Dana Point, Calif. The instrument consisted of a DermLite photographic attachment, which used 8 LEDs (light-emitting diodes) that were polarized linearly with an annular-shaped polarizer in front of the LED. The lens was designed with a removable glass faceplate, enabling acquisition of both PNCD and PCD images. In addition, 3Gen LLC provided a custom-made DermLite photographic lens attachment in which the polarizing filters were removed, enabling acquisition of conventional contact NPD images. This custom-made lens was supplied with a fixed glass plate.

The DermLite photodermoscopes were attached to the digital camera, and clinical and dermoscopic images were obtained consecutively at the same resolution and illumination. The equipment batteries were always fully charged. The first photograph was taken with the NPD lens. The lens was then switched to a polarized lens with the glass plate, and the lesion was photographed again with the lens and the subject’s skin coming in contact through a liquid interface. Both NPD and PCD were performed using alcohol (70% ethanol) as the fluid interface. Last, a photograph was taken with the polarized lens but without skin contact, the glass faceplate having been removed (PNCD). All digitized images were captured in JPEG (Joint Photographic Experts Group) format. For each case, the close-up clinical and 3 dermoscopic images (NPD, PCD, and PNCD) were placed in a $2 \times 2$ matrix for comparison. Images were evaluated for specific dermoscopic features of DF lesions (Table 1).

For each imaging method (NPD, PCD, and PNCD), descriptive frequencies were calculated for all dermoscopic features of the lesion. Lesional features were assessed as present or absent. Pairwise assessments of lesional characteristics between imaging methods were calculated as the percentage of agreement and with the $\kappa$ statistic. All statistical analyses were performed using StataSE, version 8 (StataCorp, College Station, Tex).

RESULT

The morphologic features of a classic DF at close-up photography and with dermoscopy using the 3 methods (NPD, PCD, and PNCD) are shown in Figure 1. Features of DF lesions with dermoscopy and their frequency are listed in Table 1.

DF STRUCTURES

With NPD and PCD, the most frequently observed feature was a central white patch (Figure 2A). This white scarlike area was most often well demarcated, with an irregular outline, and sometimes appeared stellate. In 33 lesions seen with PCD, this central white patch was further characterized by bright or shiny white streaks (Figure 2B). These shiny streaks were seen on lesions at direct dermoscopic examination and on photographic images.

The second most common dermoscopic feature seen was the presence of a fine pigmented network at the periphery (Figure 3). This light to medium brown pigmented network was generally characterized by a delicate and relatively uniform mesh that thinned out at the periphery, although networks with more heavily pigmented and thickened grids were occasionally seen.

Small, round to oval, light to dark brown globulelike structures were frequently seen within and at the periphery of the central white area. These structures generally appeared ringlike or doughnut shaped with a darker, thick peripheral rim (Figure 3). Vascular structures, consisting mainly of dotted vessels, were also seen prominently within the central scarlike area (Figure 4A and B). A pink to red to red-violet halo of diffuse pigmentation around the central depigmented patch was less frequently seen, while a confluent brown pigmentation surrounding the central white area was rarely seen.

With PNCD, DF lesions had an overall pink to red appearance, with a central pink hue overlying the central scarlike area, which we termed “vascular blush." This vascular blush was typically lost with skin contact dermoscopy (Figure 1C and D, and Figure 4B and C). Stromal capillaries were also more prominently visible with PNCD, with vascular structures (predominantly dotted vessels) documented in 82% of lesions compared with 48% and 44%, respectively, of lesions imaged with NPD and PCD (Table 1).

A peripheral pigmented network was observed with PNCD, but the mesh network appeared partially effaced or blurred in 12 lesions or was replaced by diffuse brown pigmentation in 9 lesions, whereas the pigmented network was previously clearly seen with NPD. This effect was not observed with the central globulelike structures, which were clearly visible with all 3 imaging methods.

When exploring levels of agreement in pairwise comparisons of dermoscopic features (Table 2), NPD and PCD showed good to excellent agreement, with the $\kappa$ statistic ranging from 0.46 to 1.00. Levels of agreement when com-

Table 1. Dermoscopy Features Observed on 50 NPD, PCD, and PNCD Images*

<table>
<thead>
<tr>
<th>Dermoscopic Characteristic</th>
<th>NPD</th>
<th>PCD</th>
<th>PNCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central white patch</td>
<td>37 (74)</td>
<td>42 (84)</td>
<td>25 (50)</td>
</tr>
<tr>
<td>Peripheral pigment network</td>
<td>36 (72)</td>
<td>36 (72)</td>
<td>27 (54)</td>
</tr>
<tr>
<td>Globulelike structures</td>
<td>21 (42)</td>
<td>22 (44)</td>
<td>21 (42)</td>
</tr>
<tr>
<td>Blood vessels</td>
<td>24 (48)</td>
<td>22 (44)</td>
<td>41 (82)</td>
</tr>
<tr>
<td>Central pink hue or vascular blush</td>
<td>6 (12)</td>
<td>5 (10)</td>
<td>44 (88)</td>
</tr>
<tr>
<td>Peripheral diffuse pink to red to red-violet halo</td>
<td>17 (34)</td>
<td>14 (28)</td>
<td>24 (48)</td>
</tr>
<tr>
<td>Peripheral halo of brown homogenous pigmentation</td>
<td>2 (4)</td>
<td>2 (4)</td>
<td>6 (12)</td>
</tr>
</tbody>
</table>

*Data are given as number (percentage).

Abbreviations: NPD, nonpolarized dermoscopy; PCD, polarized contact dermoscopy; PNCD, polarized noncontact dermoscopy.
paring NPD with PNCD and PCD with PNCD were more varied and exhibited lower levels of agreement, with the \( \kappa \) statistic ranging from 0.03 to 0.92. The only dermatoscopic feature with excellent levels of agreement in all 3 comparisons was the central globulelike structure, with the \( \kappa \) statistic ranging from 0.88 to 0.96.

DF PATTERNS

With NPD and PCD, a peripheral pigmented network in association with a central white scarlike patch (Figure 1B and C) was observed in 56% and 62% of lesions, respectively. This pattern was seen in only 26% of DF lesions.

Figure 1. Images of a classic dermatofibroma obtained using 3 methods. A, Close-up clinical image. B, Nonpolarized contact dermoscopic image. C, Polarized light contact dermoscopic image. D, Polarized light noncontact dermoscopic image. Note that the central patch appears pink under polarized noncontact dermoscopy.

Figure 2. Images of a dermatofibroma. A, Nonpolarized contact dermoscopic image shows central white scarlike patch (asterisk) and peripheral network. B, Polarized light contact dermoscopic image shows a central patch characterized by shiny white streaks.
viewed with PNCD. In contrast, a peripheral network in association with a central pink hue (Figure 1D) was observed in 46% of DF lesions seen with PNCD but in only 6% of lesions seen with NPD or PCD.

We extended pattern analysis further to determine the most frequent multicomponent patterns associated with DF lesions. Of the many combinations of dermoscopic patterns found, the 4 most common combinations for each method are given in Table 3. The combination of a peripheral pigmented network and a central white patch in addition to globulelike structures (Figure 3) was most frequent on NPD and PCD images (Figure 2A). The finding of a central white area with globulelike structures surrounded by diffuse red to brown pigmentation was seen less frequently.

With PNCD, the most frequent patterns were a combination of a central pink hue (vascular blush) together with a peripheral pigmented network and blood vessels (Figure 5A), and a vascular blush overlying a central white patch associated with a peripheral pigmented network (Figure 5B). A central vascular blush surrounded by diffuse red to brown pigmentation and vascular structures (Figure 5C) was also seen frequently.

**COMMENT**

Dermatofibromas are usually easily diagnosed from their clinical appearance. However, when the diagnosis is uncertain, such as when a darkly pigmented DF may simulate dysplastic nevi or melanoma, dermoscopy can be used to supplement normal clinical inspection and palpation.

Skin normally appears opaque owing to reflection, dispersion, or absorption of light at the stratum corneum. Light scatters as a result of the difference in refraction index (RI) between air and the stratum corneum. Conventional immersion dermoscopy enables visualization of deeper epidermal and dermal structures by decreasing incident light reflection at the skin surface and, thereby, makes the epidermis more translucent. This effect is achieved by having a liquid interface (ideally with RI equal to the skin) optically link the stratum corneum (RI = 1.55) with a glass plate (RI, approximately 1.52) mounted on the dermoscope. For this study, 70% ethanol (RI, 1.37) was used as the immersion fluid, but since 70% ethanol has an RI similar but not equal to the skin, this technique still allows some superficial backscattering of light.

Dermoscopy has become a valuable diagnostic tool for dermatologists. Dermoscopic pattern analysis and algo-
table 2. pairwise comparisons of agreement for the dermoscopic features of the study lesions

<table>
<thead>
<tr>
<th>dermoscopic characteristic</th>
<th>NPD/PCD</th>
<th>NPD/PNCD</th>
<th>PCD/PNCD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% agreement</td>
<td>k statistic</td>
<td>% agreement</td>
</tr>
<tr>
<td>Central white patch</td>
<td>82</td>
<td>0.46</td>
<td>64</td>
</tr>
<tr>
<td>Peripheral pigment network</td>
<td>100</td>
<td>1.00</td>
<td>78</td>
</tr>
<tr>
<td>Globulelike structures</td>
<td>98</td>
<td>0.96</td>
<td>96</td>
</tr>
<tr>
<td>Blood vessels</td>
<td>92</td>
<td>0.84</td>
<td>66</td>
</tr>
<tr>
<td>Central pink hue or vascular blush</td>
<td>98</td>
<td>0.90</td>
<td>24</td>
</tr>
<tr>
<td>Peripheral diffuse pink to red to red-violet halo</td>
<td>94</td>
<td>0.86</td>
<td>86</td>
</tr>
<tr>
<td>Peripheral halo of brown homogeneous pigmentation</td>
<td>92</td>
<td>1.00</td>
<td>92</td>
</tr>
</tbody>
</table>

Abbreviations: NPD, nonpolarized dermoscopy; PCD, polarized contact dermoscopy; PNCD, polarized noncontact dermoscopy.

Table 3. Most Frequent Multicomponent Dermoscopic Pattern Combinations Observed With NPD, PCD, and PNCD

<table>
<thead>
<tr>
<th>Imaging Method</th>
<th>Rank*</th>
<th>Lesions With Pattern, %</th>
<th>Blood Vessel</th>
<th>Central White Patch</th>
<th>Peripheral Network</th>
<th>Central Pink Hue</th>
<th>Peripheral Pigment Halo</th>
<th>Globulelike Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPD</td>
<td>1</td>
<td>14</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>12</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>8</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>6</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCD</td>
<td>1</td>
<td>16</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>14</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>PNCD</td>
<td>1</td>
<td>10</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>8</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Abbreviations: NPD, nonpolarized dermoscopy; PCD, polarized contact dermoscopy; PNCD, polarized noncontact dermoscopy; +, present.

*The frequency of combinations of dermoscopic patterns was assessed for each imaging method. This table ranks these dermoscopic patterns by relative frequency. The 4 most common multicomponent dermoscopic patterns or combinations for each method are given.

Algorithm to differentiate pigmented lesions has led to improved diagnostic accuracy. For example, a pigmented network is a hallmark of a melanocytic lesion, but some nonmelanocytic lesions, including DF lesions, can also display a pigmented network. Knowledge of additional classic dermoscopic criteria for DF may enable further confirmation of the diagnosis. However, with the introduction of polarized light dermoscopy in recent years, there are commercially available handheld devices that offer cross-polarized–light dermoscopy. Unlike conventional fluid immersion dermoscopy, polarized light dermoscopy enables visualization of deeper skin structures without the need for a liquid interface in contact with the skin. These devices have 2 perpendicular polarizing filters that block all reflected light from the skin surface and, therefore, detect mostly backscattered light from the deeper layers of the skin. Hence, this new technique is similar but not equivalent to conventional dermoscopy, and clinicians should be aware of some differences of dermoscopic features when evaluating lesions under polarized light. For example, it has been observed that colors observed with conventional dermoscopy are sharper and less distorted than with polarized dermoscopy. A recent report by Zaballos et al describes some new dermoscopic features of hemosiderotic and aneurysmal DF lesions by using polarized dermoscopy.

When NPD and PCD were used, we found results similar to those previously reported. Our data likewise suggest that a pigmented network surrounding a central white scarlike area is the most common dermoscopic feature of DF lesions. In general, images obtained with NPD and PCD appeared similar, although light brown and dark brown areas on the PCD images appeared subjectively darker when compared with the NPD images. There was high percentage of agreement together with good to excellent levels of agreement (k statistic) for NPD and PCD images at pairwise comparisons of dermoscopic structures (Table 2).

When comparing NPD with PCD images, the central white patch had the least agreement among the structures because the fibrotic stroma appeared as a white scarlike area with conventional dermoscopy, but with PCD, this central white patch typically revealed conspicuous shiny white streaks. At histopathologic analysis, the scarlike area seen with dermoscopy may be the result of the presence of fibrosis in the dermis and the presence of near-perfect parallel waves of acellular collagen. The difference in characteristics of the central scarlike white patch on NPD and PCD images may be attributed to better visualization of the deeper dermal collagen component with polarized light dermoscopy. With conventional dermoscopy, there is still some incident reflected light that prevents clear visualization of the deeper dermis; this may...
account for the inability to visualize the shiny white streaks with conventional dermoscopy. Similarly, white linear structures, attributed to underlying fibrosis, have been reported with hemosideric DF lesions using polarized light dermoscopy. We have also observed similar shiny streaks in other lesions with a fibrotic stroma, such as biopsy scars and melanoma (A.A.M., unpublished data, 2005-2006).

In contrast, images of DF lesions viewed with PNCD were quite different when compared with lesions viewed with NPD and PCD. There was markedly less percentage of agreement and lower levels of agreement (k statistic) when comparing NPD with PNCD and PCD with PNCD, with only the globulelike structures having consistently excellent agreement between methods (Table 2). This lack of agreement is mainly the result of better visualization of vasculature with PNCD. At histologic analysis, DF lesions may have an increased number of telangiectasias in the papillary and upper reticular dermis in association with a sclerotic stroma. The combination of these features is why a DF lesion is sometimes referred to as a sclerosing hemangioma. As can be expected, the underlying vasculature in DF lesions is strikingly more evident when lesions are viewed with PNCD than with conventional dermoscopy. We observed that the DF lesions had an overall pink to red appearance, with central and peripheral dotted blood vessels seen more prominently with PNCD than with NPD or PCD. Moreover, lesions viewed with PNCD had a distinctive central pink hue or vascular blush overlying or partially obscuring the central white patch or white streaks. When comparing PNCD images with PCD images, the vascular blush is lost. This finding can be explained by the pressure of the lens on the skin when using PCD; this forces blood out of the vessels and produces images resembling those obtained with conventional dermoscopy. These differences in characteristics account for the poor level of agreement of 3 structures (central white patch, vascular blush, and vascular structures) when comparing PNCD with the other imaging methods.

Another observed difference was that the stereotypical peripheral pigment network of DF would occasionally appear blurred and indistinct with PNCD compared with NPD and PCD. This finding was probably the result of technical problems with focus during photography. Dermatofibromas are often slightly elevated, and the lack of a flat surface to photograph at PNCD may account for some problems with focus at the periphery.

At histologic analysis, both the peripheral pigmented network and the brown globulelike structures are most likely the dermoscopic manifestations of the pigmented rete ridges of the epidermis. Rete ridge pattern may vary between thin and broad-based ridges, with melanin pigment concentrated in the basal layer of the epidermis. The delicate pigmented network surrounding the central white patch may correlate with hyperpigmented thin rete ridges appearing peripheral to the central fibrosis, while the ringlike or globulelike structures may be the broad-based rete ridges showing pigment over a greater surface area. This observation has been confirmed by confocal microscopy (A.A.M., unpublished observation, 2005-2006). The reason for an increase in pigmentation is not the result of an increase in melanocytes, as seen in melanocytic tumors, but is due to increased transfer of melanin from melanocytes to keratinocytes in the basal layer of the epidermis.

We also evaluated the overall dermoscopic patterns of DF by using the 3 imaging methods. We were able to find similar multicomponent dermoscopic patterns with NPD and PCD. Our data corroborate the previously reported finding that a peripheral pigmented network in combination with a central white area is seen most frequently in DF lesions. When other dermoscopic struc-
Conclusions

Conventional direct contact dermoscopy and polarized dermoscopy may not be equivalent, but when used in combination, they may provide complementary information. Knowledge and recognition of these features and patterns may confirm or solidify a clinical diagnosis of DF and help to exclude other lesions from the differential diagnosis.

A limitation of this study is that the included DF lesions were not all further examined for their histologic variants. A different set of or additional criteria may be necessary for detection of specific variants of DF. This study should serve to heighten the awareness of clinicians to consider these differences in dermoscopic features when evaluating other pigmented lesions using polarized light dermoscopy. Herein lies a problem: at present, workshops, didactic lectures, peer-reviewed publications, and atlases on dermoscopy are commonly based on studies that used direct contact NPD. Our findings highlight several salient differences between the various methods of dermoscopy found with this one lesion, DF. More studies with this new technology may reveal other dermoscopic features that may prove helpful in the accurate diagnosis of other pigmented and nonpigmented lesions.

Accepted for Publication: March 30, 2006.

Correspondence: Ashfaq A. Marghoob, MD, Dermatology Service, Department of Medicine, Memorial Sloan-Kettering Cancer Center, 160 E 53rd St, New York, NY 10022 (marghooa@mskcc.org).

Author Contributions: Dr Marghoob had full access to all data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Agero, Taliercio, and Marghoob. Acquisition of data: Agero, Taliercio, Salaro, Chu, and Marghoob. Analysis and interpretation of data: Agero, Taliercio, Dusza, Salaro, Chu, and Marghoob. Drafting of the manuscript: Agero, Taliercio, Dusza, and Marghoob. Critical revision of the manuscript for important intellectual content: Agero, Taliercio, Dusza, Salaro, Chu, and Marghoob. Statistical analysis: Taliercio, Dusza. Administrative, technical, and material support: Agero, Taliercio, Dusza, Salaro, and Marghoob. Study supervision: Chu, and Marghoob.

Financial Disclosure: None reported.

Acknowledgment: The dermoscopes used in this study were supplied by 3Gen LLC, Dana Point, Calif.

REFERENCES