Objective: To describe the dermoscopic features, including vascular structures and patterns associated with dermatofibromas in a large series of cases.

Design: Digital dermoscopic images of the prospectively collected dermatofibromas were evaluated for the presence of multiple structures and patterns.

Settings: Dermatofibromas were collected in the Departments of Dermatology of the Hospital de Sant Pau i Santa Tecla, Tarragona, Spain, and Hospital de Sant Llatzer, Palma de Mallorca, Spain.

Patients: A total of 412 dermatofibromas (from 292 patients) with complete documentation were collected.

Main Outcome Measures: Frequency and intraobserver and interobserver agreement of the dermoscopic structures and patterns in dermatofibromas.

Results: A total of 19 morphological dermoscopic structures were evaluated. Pigment network was observed in 71.8% (3% atypical pigment network), white scarlike patch in 57.0%, and a white network in 17.7%. Different vascular structures were observed in 49.5% (dotted vessels in 30.6%). Ten dermoscopic patterns were observed. The most common pattern seen in our series (34.7% of cases) was central white patch and peripheral pigment network, but in 65.3% of the cases, dermatofibromas presented different patterns including simulators of melanoma.

Conclusion: The most common pattern associated with dermatofibroma is the classic dermoscopic pattern (pigment network and central white patch), but this tumor has a wide range of presentations.

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Dermatofibroma has been recently defined as (1) a fibrosing cutaneous lesion characterized by an increased number of fibrocytes in the dermis and occasionally subcutis; (2) a variable admixture of macrophages and other inflammatory cells frequently including lymphocytes and rarely eosinophils, neutrophils, and/or plasma cells, with coarse collagen bundles in haphazard array often with peripheral entrapment; and (3) hyperplasia of adjacent structures (epidermis and hair follicles) or cells (melanocytes). Dermatofibroma is a very common cutaneous lesion that most frequently affects young or middle-aged adults, with a slight predominance in female patients. Clinically, dermatofibromas appear as firm, single or multiple hard papules, plaques, or nodules, with a smooth surface, usually characterized by a color variable from light brown to dark brown, purple-red, or yellow. They can develop anywhere on the body surface, with a predilection for the lower extremities, and their size can range from a few millimeters to 2 cm. Although the clinical diagnosis of dermatofibroma is rather easy, in some instances the differentiation from other tumors, such as melanoma, is difficult.

Dermoscopy (dermatoscopy or epiluminescence microscopy) is an in vivo, noninvasive technique that has revealed a new dimension of clinical morphologic features in pigmented and nonpigmented skin lesions. Apart from sporadic case reports, systematic analysis of the dermoscopic features of dermatofibromas has been performed in case series in previous interesting studies, but these included a relatively low number of patients. Because dermatofibroma is a frequent benign tumor that may mimic other skin tumors including malignant melanoma, the precise definition of the dermoscopic findings and patterns for this lesion is of major interest.

The aim of this study was to analyze the dermoscopic features, including vascular structures, of dermatofibromas in a large prospective series of cases.
Two sources of clinical cases were used in this study. These sites were the Departments of Dermatology of the Hospital de Sant Pau i Santa Tecla, Tarragona, Spain (site 1) and the Hospital de Sant Llatzer, Palma de Mallorca, Spain (site 2). All dermatofibromas were examined by experienced “dermoscopists” using a DermLite (3Gen LLC, Dana Point, California) at 20- to 50-fold magnification. No pressure was used to avoid the collapse of the vessels in the lesions. All dermatofibromas were collected prospectively in a period of 3 years (from January 1, 2003, to January 1, 2006).

Clinical data were obtained for each patient, including age and sex, the location of the lesion, and the size of the lesion. Because the diagnosis of dermatofibroma is usually clinical, we considered systematic biopsy (and histopathologic examination) as unethical, even though this might introduce a selection bias. Therefore, a biopsy was performed on patient request or in difficult and atypical cases (ie, melanocytic lesion could not be ruled out with certainty) or in hemosiderotic and aneurismal dermatofibromas.

A list of dermoscopic criteria established by the Consensus Net Meeting on Dermoscopy,8 the study of vascular structures described by Argenziano et al,13 and the dermoscopic description of dermatofibromas performed by various authors7-12 were evaluated by 1 of the contributing investigators experienced in dermoscopy (P.Z.). These criteria and their frequency in dermatofibromas are given in Table 1. The dermoscopic structures most commonly found in dermatofibromas were used to build up 10 global patterns, and all dermatofibromas were evaluated for the presence of these patterns (Table 2).

All the lesions in this study were evaluated for the presence of dermoscopic structures and patterns by 1 of the contributing authors (P.Z.). The interobserver and intraobserver reproducibility were assessed for each dermoscopic structure and pattern evaluated for 30 lesions, randomly selected from the 412 dermatofibromas included in the study. Regarding interobserver reproducibility, one observer (P.Z.) evaluated each structure and pattern and reevaluated them 3 months later. Regarding interobserver reproducibility, one experienced observer (A.L.) evaluated the same lesions as evaluated by P.Z., and the results were compared. Data analysis was performed using the SPSS 10.0 program for data management (SPSS Inc, Chicago, Illinois), which calculated \( \kappa \) statistics with approximate significance. With regard to the interpretation of \( \kappa \) values: a value of 1.0 indicates perfect agreement, values greater than 0.8 are considered excellent, values between 0.6 and 0.8 are good, values between 0.4 and 0.6 are fair, and values less than 0.4 are poor. Regarding dermoscopic patterns, 50 lesions were randomly selected from the 412 dermatofibromas included in the study, and the percentage agreement between the observers A.L. and P.Z. was evaluated.

The study protocol was approved by the local research ethics committee of the Hospital Universitari de Sant Joan/Faculty of Medicine, Reus, Spain. All participants gave oral informed consent.
A total of 292 patients (201 female [68.8%] and 91 male [31.2%]) aged 24 to 70 years (median age, 45 years), with a clinical and dermoscopic diagnosis of dermatofibromas were evaluated. The total number of dermatofibromas was 412; a single lesion was observed in 222 patients, whereas 45 patients presented with 2 dermatofibromas, 18 with 3, 7 with 4, 3 with 6, 1 with 7, and 1 with 8. Of the 412 dermatofibromas, 342 were located on the lower limbs, 37 on the upper limbs, 21 on the trunk, 10 on the buttocks, and 2 on the face. The size of dermatofibromas ranged from 3 mm to 4 cm (median size, 6 mm). Histologic examinations were performed in 121 lesions (29.4%) that confirmed the diagnosis of dermatofibromas in all cases.

A careful dermoscopic examination of the lesions allowed the observation of the following features:

1. Pigment network was observed in 296 of the 412 dermatofibromas (71.8%). A delicate pigment network characterized by thin lines of light brown color and regular meshes was observed in 283 cases (68.7%), whereas a prominent and/or atypical pigment network was observed in 13 dermatofibromas (3.1%). In 209 of these cases (70.6%), this structure was located at the periphery; in 79 cases (26.7%), it was located throughout the lesion; and in 8 cases (2.7%), it was irregularly distributed. All dermatofibromas with a prominent or atypical pigment network and/or with an irregularly distributed pigment network were excised and diagnosed histopathologically.

2. A white scarlike patch was observed in 235 of the 412 dermatofibromas (57.0%). In 175 of these cases (74.5%), this structure was located in the center; in 29 cases (12.3%), multiple white scarlike patches were observed; in 24 cases (10.2%), the white scarlike patch was throughout the lesion; and in 7 cases (3.0%), it was irregularly distributed.

3. White network, a variant of the white scarlike patch described by our group,11 was observed in 73 of the 412 dermatofibromas (17.7%). In 61 of these cases (83.6%), this structure was located in the center; in 8 cases (11.0%), it was located throughout the lesion; and in 4 cases (5.6%), it was irregularly distributed.

4. Homogeneous pigmentation was found in 102 dermatofibromas (24.8%). In 56 of these cases (54.9%), this structure was located at the periphery; in 24 cases (23.5%), it was located throughout the lesion; in 19 cases (23.5%), it was located in the center; and in 3 cases (2.9%), it was irregularly distributed. Of the cases of peripheral and irregular homogeneous pigmentation, 87.5% of total homogeneous coloration and 47.4% of central homogeneous pigmentation had brown coloration, whereas 52.6% of central homogeneous pigmentation and 12.5% of total homogeneous pigmentation had bluish or red-bluish coloration.

From these main dermoscopic structures observed in the dermatofibromas, 10 patterns were identified (Figure 1). These patterns can be grouped into 2 categories: dermatofibromas with peripheral delicate pigment network and those without peripheral delicate pigment network. Dermatofibromas with peripheral delicate pigment network included the following patterns:

- Pattern 1: pigment network located throughout the lesion (Figure 2A).
- Pattern 2: delicate pigment network at the periphery and central white scarlike patch (Figure 2B).
- Pattern 3: delicate pigment network at the periphery and central white network (Figure 2C).
- Pattern 4: delicate pigment network at the periphery and central homogeneous pigmentation (Figure 2D).

Dermatofibromas without peripheral delicate pigment network included the following patterns:

- Pattern 5: white network throughout the lesion (Figure 3A).
- Pattern 6: homogeneous pigmentation throughout the lesion (Figure 3B).
- Pattern 7: total scarlike patch (pattern 7a, Figure 3C) and a variant with multiple white scarlike patches regularly distributed (pattern 7b, Figure 3D).
- Pattern 8: peripheral homogeneous pigmentation and central white scarlike patch (Figure 4A).
- Pattern 9: peripheral homogeneous pigmentation and central white network (Figure 4B).
- Pattern 10: atypical pattern that consists of the presence of atypical pigment network, atypical scarlike patch or white network, atypical homogeneous pigmentation, or irregular distribution of these structures (Figure 4C and D).

The frequency of patterns and schematics illustrating these findings are shown in Figure 1 and Table 2. Vascular structures in dermatofibromas are shown in Figure 5. As given in Table 1, 204 of the 412 dermatofibromas (49.5%) showed vascular structures. Addi-
tional dermoscopic structures are shown in Figure 6 and Table 1. Table 1 also summarizes the intraobserver agreement and interobserver agreement for the dermoscopic structures found in dermatofibromas. The majority of structures revealed fair to excellent levels of agreement. In regard to the patterns, 48 of 50 dermatofibromas were classified as having the same pattern by the 2 observers who evaluated the lesions (P.Z. and A.L.), with a percentage agreement of 96%.

**COMMENT**

In 2001, the Board of the Consensus Net Meeting on Dermoscopy agreed on a 2-step procedure for the classification of pigmented lesions of the skin. At the first level of decision making, the observer has to decide whether the lesion is of melanocytic or nonmelanocytic origin. Although the presence of a pigment network is a major dermoscopic criterion for melanocytic lesions, there are many exceptions to the rule, including dermatofibromas. The results of our study reveal the presence of pigment network in 71.8% of dermatofibromas. This dermoscopic structure was found at the periphery of dermatofibromas in 70.6% of cases, throughout the lesion in 26.7%, and irregularly distributed in 2.7%. The pigment network was delicate in 68.7% of cases (95.6% of dermatofibromas with pigment network) and prominent or atypical in 3.1% of dermatofibromas. The delicate pigment network associated mainly with dermatofibromas is usually light to medium brown, fine, and delicate and gradually fades into the surrounding skin.

Although the network of melanocytic lesions may appear remarkably similar, pathophysiologically in dermatofibromas, this structure results from hyperpigmentation rather than from melanocytic proliferation at the basal layer. However, the progressive accumulation of melanin into the basal and upper layers of epidermis and the epidermal hyperplasia could explain the cases of non-delicate pigment network and the presence of light to dark brown globulelike structures and dots. We found the presence of these globulelike structures and dots in 41.6% of dermatofibromas. These globulelike structures are formed because the rete ridges are often flat, confluent, and hyperpigmented and are not caused by nests of melanocytes. These flattened and broad rete ridges are also
responsible for the small ringlike structures, a kind of globule with a darker peripheral rim, which we found in 25% of our dermatofibromas. Agero et al found globulelike structures, including ringlike ones, in 44% of dermatofibromas using polarized contact dermoscopy. Furthermore, depending on the degree and location of the epidermal hyperpigmentation and skin phototype, the pigment network can be replaced by a homogeneous brown area that we found in 21.6% of dermatofibromas. The presence of pigment network and globulelike structures in previous studies is compared in Table 3. It is important to note that cases of dermatofibromas with prominent or atypical pigment network and/or with an irregular localization may be difficult to differentiate from melanoma and biopsy is mandatory.

Another dermoscopic structure frequently found in dermatofibromas of our study is the white scarlike patch. This structure is defined as a more or less irregularly outlined and sharply demarcated white area whose histopathologic correlation is the pronounced fibrosis within the papillary dermis. The results of our study reveal a white scarlike patch in 57.0% of dermatofibromas that was mainly seen in the center of the lesion (74.5%). In the study by Ferrari et al, the most frequent dermoscopic criteria was the central white scarlike patch that was described in 91.6% of dermatofibromas. Agero et al found a central white network in 84% of dermatofibromas using polarized contact dermoscopy (Table 3). We found multiple scarlike patches in 12.3% of dermatofibromas with a scarlike patch, and it is important to note that Blum and Bauer described a case of melanoma dermoscopically mimicking a dermatofibroma with 4 central white scarlike patches and a delicate pigment network at the periphery. All of our cases of dermatofibroma with multiple scarlike patches were excised and histologically diagnosed as dermatofibromas. Recently, our group described a new dermoscopic finding called white network, mostly occurring in cases of large lesions (>1 cm). This network, composed of white lines and brown holes and seen in 17.7% of the dermatofibromas in our study, is considered a variation of the classic white scarlike patch with a similar histopathologic correlation. It is important to differentiate this dermoscopic structure of the negative pigment network or inverse of the pigment network associated with Spitz nevi, dysplastic nevi, and melanomas. Histopathologically, inverse of pigment network represents elongated hypomelanotic rete ridges and large nests of pigmented cells located at the dermal papillae. Der-
moscopically, it is characterized by a “negative” of the pigment network, with light (not white) areas making up the grids of the network and dark areas filling the holes. In doubtful cases or in any case with irregular distribution of white network, excision is mandatory.

Vascular structures are one of the criteria used for the dermoscopic diagnosis of melanoma and other pigmented and vascular tumoral lesions that may simulate melanoma. However, in spite of the importance of this topic, studies looking for the presence of different dermoscopic vascular structures in dermatofibromas are lacking. Argenziano et al,13 in their exhaustive study of different vascular structures in 531 melanocytic and nonmelanocytic skin tumors, do not include any dermatofibromas. Ferrari et al7 found a reddish coloration located around the central white scarlike patch in 29.2% of their series of 24 dermatofibromas. Blood vessels were observed in 44% of dermatofibromas in the study by Agero et al10 when polarized contact dermoscopy was used. These authors also found a central pink hue in 10% of cases and a peripheral diffuse pinkish or reddish area in 28% of cases using polarized contact dermoscopy (Table 3). In our study, we found vascular structures in 49.5% of dermatofibromas. The most common vascular structure seen in our cases was erythema (31.5%), followed by dotted vessels (30.6%). Dotted vessels are defined as tiny red dots densely aligned next to each other in a more or less regular fashion. Argenziano et al13 found this vascular structure in 77.8% of Spitz nevi, 25.7% of Clark nevi, and 22.7% of melanomas. In the study by Argenziano et al,13 dotted vessels showed a positive predictive value for a melanocytic lesion of 90%, and the probability of a lesion with dotted vessels being a melanoma was 37.8%. Ferrari et al15 described 2 dermatofibromas with a dotted vessels pattern, one of these in the absence of other pigmented dermoscopic structures. Other vascular structures found in the dermatofibromas in our study are described in Table 1.

Other dermoscopic structures were found in dermatofibromas including scales (12.4%) and ulceration (4.4%), presumably reflecting external injury. We appreciated a yellowish homogeneous area in 4.4% of le-

Figure 4. Patterns of dermatofibroma. A, Peripheral homogeneous pigmentation and central white scarlike patch (pattern 8). This lesion also shows dotted vessels and erythema. In this case, the diagnosis of Spitz nevus or melanoma cannot be definitively ruled out and biopsy is mandatory. The histopathologic examination revealed a dermatofibroma. C, Atypical pattern (pattern 10). In this lesion, atypical pigment network (on the left), irregularly distributed delicate pigment network, homogeneous areas (pinkish on the left and yellowish in the upper part), scales, and dotted vessels can be observed. The histopathologic examination revealed a dermatofibroma. D, Atypical pattern (pattern 10). A multicomponent pattern with atypical pigment network located on the right, erythema with dotted vessels located on the left, and a central blush homogeneous area with white structures can be observed in this aneurysmatic dermatofibroma, which was also confirmed by histopathologic examination. (DermLite Foto; 3Gen LLC, Dana Point, California [original magnification ×10 for all].)
sions that may correspond histopathologically to areas of lipidization with lipophages and Touton giant cells, which can be found in some early lesions or cholesterol and lipidized dermatofibromas. Moreover, we found fissures and ridges (2.7%) and exophytic papillary structures (1.5%) in dermatofibromas with prominent epidermal hyperplasia. These dermoscopic structures are generally associated with seborrheic keratosis and less frequently in compound and dermal nevi and represent deep invaginations of epidermis, filled with keratin.2-5 A bluish or red-bluish homogeneous pigmentation (3.2%) was present in hemosiderotic or aneurysmatic dermatofibromas. Other authors have stated that this pigmentation is associated with this type of dermatofibroma,9,16-18 and the histopathological correlation of this structure could be the presence of the prominent blood-filled spaces and intracellular and extracellular hemosiderin deposition. In these cases, some of them with multicomponent pattern, the diagnosis of melanoma cannot be ruled out and excision should be performed.

We identified 10 global patterns for dermatofibromas (Table 2). Some of these patterns are composed of a single dermoscopic structure located throughout the entire lesion (delicate pigment network, white scarlike patch, white network, and homogeneous pigmentation). Other patterns are composed of combined dermoscopic structures, and we included an atypical pattern to include those cases with atypical dermoscopic structures or irregular distribution. The most common pattern seen in our series was pattern 2 (peripheral pigment network and central scarlike white patch) (34.7% of dermatofibromas). Ferrari et al7 found this pattern in 79% of dermatofibromas, and Agero et al10 found this in 62% of cases (Table 3). Pattern 1 (total delicate pigment network) was the second most frequent pattern observed in dermatofibromas (14.6%). Only in a very few cases were dermatofibromas difficult to differentiate from melanocytic nevus, but the dimple sign was helpful.

In conclusion, the most frequent dermoscopic pattern associated with dermatofibromas is the central white scarlike patch and peripheral delicate pigment network. Dermatofibromas (a very common skin tumor) present a variety of dermoscopic patterns that may suppose difficulties in the dermoscopic diagnosis. In this study, we were not able to elucidate the specificity of each pattern for the diagnosis of dermatofibroma. Finally, the distinction between dermatofibroma and other benign or malignant tumors will only be possible with histopatho-
logic examination in the cases of atypical or more infrequent patterns. These study results are based on polarized contact dermoscopy using a fluid interface; therefore, these results and conclusions may not be fully transferable to the evaluation of dermatofibromas using nonpolarized dermoscopy.

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Author Contributions: Study concept and design: Zaballos. Acquisition of data: Zaballos and Llambrich. Analysis and

Table 3. Frequency of Dermoscopic Structures and Patterns of Dermatofibromas Described in the Literature

<table>
<thead>
<tr>
<th>Dermoscopic Structure</th>
<th>Ferrari et al, %</th>
<th>Arpaia et al, %</th>
<th>Agero et al, %b</th>
<th>Zaballos et al, % (Present Study)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigment network</td>
<td>83</td>
<td>100</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Brown dots and globules</td>
<td>29</td>
<td>&lt;13a</td>
<td>44</td>
<td>42</td>
</tr>
<tr>
<td>White scarlike patch</td>
<td>92</td>
<td>&gt;56a</td>
<td>84</td>
<td>57</td>
</tr>
<tr>
<td>Vascular structures</td>
<td>29</td>
<td>NS</td>
<td>44c</td>
<td>48</td>
</tr>
<tr>
<td>Peripheral pigment network and central white patch</td>
<td>79</td>
<td>&gt;56a</td>
<td>62</td>
<td>35</td>
</tr>
</tbody>
</table>

Abbreviation: NS, not studied.

a Arpaia et al identified 3 dermoscopic patterns: (1) isolated presence of pigment network (31%), (2) peripheral pigment network associated with globules and dots or with scale crusts and sometimes also with central white patch (13%), and (3) peripheral pigment network with a central white area (56%). This is the reason for the greater than and less than signs in the table.

b Percentages associated when polarized contact dermoscopy was used.

c Agero et al also described a central pink hue or vascular blush in 10% of dermatofibromas and a peripheral diffuse pink to red-violet halo in 28% of cases.

Figure 6. Other dermoscopic structures. A, Dermatofibroma (pattern 1) with ulceration in the lower part of the lesion (square). B, Dermatofibroma (pattern 10) with globulelike structures (black square), ringlike structures (red square), and scales (green square). C, Dermatofibroma (pattern 8) with fissures and ridges (square) and globulelike structures. D, Dermatofibroma (pattern 2) with ringlike structures throughout the entire lesion. (DermLite Foto; 3Gen LLC, Dana Point, California [original magnification ×10 for all].)
interpretation of data: Zaballos, Puig, and Malvehy. Drafting of the manuscript: Zaballos. Critical revision of the manuscript for important intellectual content: Puig, Llambrich, and Malvehy. Administrative, technical, and material support: Zaballos. Study supervision: Puig, Llambrich, and Malvehy. Financial Disclosure: None reported.

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