The diagnosis of scabies infestation is straightforward in cases where mite parts are largely visible; however, mites are often not captured in a specimen’s planes of section. Polariscopic examination is a fast and simple adjunctive diagnostic tool to light microscopy. We describe the unique polariscopic findings in scabies infestation. Two cases of crusted scabies and eight cases of typical scabies were subjected to polariscopic examination. Diagnostic mite parts were visualized in at least one section in all cases. Attached and detached spines as well as scybala (fecal material) are polarizable. Specifically, spines show a polarizable outer sheath with dark central core while scybala show peripherally concentrated, stippled birefringence. Similar stippled birefringence is visible within the gut of some mites whereas significant birefringence is not appreciated in other mite parts. These results suggest that polariscopic examination is a helpful clue in the diagnosis of scabies infestation, especially in cases where the body of the mite is not visualized.

Keywords: demodex, polarize, scabies

Foo CW, Florell SR, Bowen AR. Polarizable elements in scabies infestation: a clue to diagnosis.

diagnosis of scabies was made in all ten cases because of the presence of visible mite parts under light microscopy. For comparison, additional non-scabies specimens harboring the relative of scabies, Demodex, were subjected to polariscopic examination.

**Results**

Under polariscopic light, scabetic spines are circular on cross-section and show a dark center with peripheral birefringence (Figs. 1 and 2). Spines measure up to 50 μm in length and 1–10 μm in width. Scybala show a stippled birefringence that is concentrated peripherally. Even scybala retained in gut show similar stippled birefringence (Figs. 1 and 2). In the four cases, polarizable spines and scybala were visualized in sections that lacked a visible mite body. Other mite body parts and pink ‘pig-tails’ do not polarize.

With light microscopy alone, mite parts, scybala, attached and detached spines and pink ‘pig-tails’ were visualized separately or in combination in the stratum corneum of all 10 scabies cases. Mite bodies were visualized in at least one profile in nine cases. Polarizable fecal pellets (scybala) within the mite or external to the mite were visualized in six cases. Spines were visualized in all 10 cases, being attached to mites in 9 cases and detached in 6 cases. Pink ‘pig-tails’ were visualized in two cases. In four cases, there were profiles where polarizable elements were the only evidence of scabies infestation, while other profiles on the slide showed diagnostic mite body parts (Fig. 4). Results are summarized in the Table 1.

Demodex mites are common inhabitants within hair follicles, and as relatives of scabies, we studied their polariscopic features for comparison. On light microscopy small, granular, brown, inclusions were identified within the abdomen of Demodex mites, but not in their surroundings. These inclusions showed stippled birefringence similar to scabies fecal material and may represent Demodex fecal material (Fig. 3). In addition, tiny claw-like projections from Demodex leg tips are faintly polarizable. The polariscopic features of Demodex were easily distinguished from polarizable scabetic parts because of disparities in size, shape and location.

**Discussion**

Polarized light microscopy is a quick, simple and inexpensive assistive method of examining specimens in cutaneous pathology. Foreign body material such as suture fragments, talc, starch, plant material, cryptococcal organisms and cosmetic fillers are polarizable. Likewise, endogenously produced crystals including urate, calcium pyrophosphate and oxalate are also birefringent with polarized light microscopy. Amyloid deposits are identified with the Congo red staining method combined

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Fig. 1. Scabies mite with longitudinally sectioned attached and detached spines (A) showing central dark core and peripheral birefringence with polarized light (B). Internal scybala shows stippled birefringence. The stratum corneum also shows faint pink-white birefringence.

Fig. 2. Scabies mite and scybala with routine light microscopy (A) and polarized light microscopy (B). Scabies mite body (1), internal fecal material (2), external scybala (3), attached spine (4) and detached spines (5).
The polariscopic features of scabies mites became a topic of study after analysis of a scalp biopsy from a 51-year-old woman submitted with clinical information of ‘scalp itch’. The specimen consisted of a thick hyperkeratotic stratum corneum containing brown, apparently foreign material that was strikingly birefringent (Fig. 4A,B). This brown material was determined to be scybala once leveled sections identified mite body parts and a conversation with the clinician indicated that scabies was suspected because the patient’s son was affected. Further investigation revealed that scabies spines are also polarizable.

All scabies cases in our series showed birefringent elements when examined under polarized light microscopy. These polarizable elements consisted of attached and detached spines as well as scybala, while mite bodies and pink ‘pig tails’ (egg cases) were not polarizable. Detached spines are difficult to see with traditional light microscopy but are very easily visualized when polarized. In fact, polarizable elements were identified in the absence of other nearby mite parts in four of our cases, and served as the only diagnostic evidence of scabies in these profiles (Fig. 4).

with polariscopic examination and normal skin structures including hair, collagen bundles, the stratum corneum and even intracellular keratin tonofilaments are polarizable to varying degrees.10

Table 1. Number of scabies cases demonstrating specific diagnostic features out of a total of 10 cases

<table>
<thead>
<tr>
<th>Polarizable or histopathologic feature</th>
<th>Number of cases with this feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarizable spines</td>
<td>10/10</td>
</tr>
<tr>
<td>Attached spines</td>
<td>9/10</td>
</tr>
<tr>
<td>Detached spines</td>
<td>6/10</td>
</tr>
<tr>
<td>Both attached and detached spines</td>
<td>5/10</td>
</tr>
<tr>
<td>Polarizable scybala</td>
<td>6/10</td>
</tr>
<tr>
<td>External scybala</td>
<td>3/10</td>
</tr>
<tr>
<td>Internal scybala</td>
<td>6/10</td>
</tr>
<tr>
<td>Both internal and external scybala</td>
<td>3/10</td>
</tr>
<tr>
<td>Mite body visible in at least one profile</td>
<td>9/10</td>
</tr>
<tr>
<td>Pink ‘pigtails’ (abandoned egg cases)</td>
<td>7/10</td>
</tr>
<tr>
<td>Polarizable elements the only diagnostic feature</td>
<td>4/10</td>
</tr>
<tr>
<td>feature in at least one profile (although mite body visualized elsewhere on the slide)</td>
<td>4/10</td>
</tr>
</tbody>
</table>
Polarizable elements in scabies

Fig. 4. Four cases demonstrated sections where polarizable scabies parts were the only diagnostic feature, although mite bodies were confirmed elsewhere on the slide. Polarizable scybala are seen in case 1 (A and B) and case 3 (E and F). Case 2 (C and D) and case 4 (G and H) show polarizable detached spines. Case 1 represents crusted scabies and case 2, 3 and 4 are classic scabies.

*S. scabiei* is recognized by its oval, ventrally flattened body, four pairs of legs and numerous cuticular spines. The female scabies mite measures about 0.3–0.5 mm, and lays between 60 and 90 eggs during its adult lifespan. The entire 30-day life cycle of the scabies mite is completed within the human epidermis where it is thought to feed on lysed epidermal material. *Demodex* mites are intrafollicular parasitic mites commonly encountered as an incidental finding in skin specimens from sebaceous regions. While not typically confused with scabies because of their elongated bodies, different distribution (head and neck as opposed to trunk and extremities) and intrafollicular habitat, *Demodex* mites are related to *S. scabiei* and share some histopathological features. Small claw-like projections from *Demodex* legs are polarizable but are tiny in comparison with scabies spines (Fig. 3). In addition, small, birefringent concretions are present within the abdomen of *Demodex* mites that may represent fecal material given their similarity to scabies scybala. In contrast to scabies, these polarizable concretions were only identified within the body of the *Demodex* mite and not in its surroundings. Like scabies, *Demodex* feed on corneocytes, although their diet also includes sebum. Corneocytes of the stratum corneum are polarizable and Gonzalez-Serva et al. have reported polarizable crystals in sebum raising the possibility that the intraabdominal birefringent material in both scabies and *Demodex* scybala may be related to an intrinsic characteristic of the mites’ diet. The polariscopic features of other parasitic organisms such as tungiasis or larva migrans have not been described, although the mouth hooks, larval spiracles and spines of the intradermal parasite, *Dermatobia hominis*, are reportedly polarizable. As the size and location of these parasites are very different than scabies, they are not typically considered in the same differential diagnosis.

Many foreign polarizable materials may be present in or on the stratum corneum including talc, fiberglass and titanium, and as many pathologists have noted there are a myriad of non-specific polarizable fragments on slides, on the surface of the skin and within serum crust. All of these may present potential pitfalls when using polarized light to assist in the diagnosis of scabies. However, familiarity with the specific polariscopic features, size and location of scabies elements should help the pathologist avoid making an incorrect diagnosis. Scybala are rounded, amorphous masses with stippled, peripheral birefringence while spines are small and delicate, measuring 1–10 μm in diameter and up to 50 μm in length, and show polarizable outer cortex with a dark central core that is visualized as birefringent parallel lines. Both appear in cavities within the stratum corneum. Polarizable material sitting on the surface of the stratum corneum is most probably non-specific.

Given the small number of mites that infest the skin in most cases of human scabies, it can be difficult to actually capture a mite within a skin biopsy. Moreover, mite parts and scybala can easily be overlooked with traditional light microscopy. The addition of polariscopic examination provides a rapid and convenient adjunctive tool in the identification of scabies infestation and can increase the probability of making the correct diagnosis.

References


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