The mite *Demodex canis* is an ectoparasite and a normal inhabitant of canine hair follicles and sebaceous glands of the skin.1–3 Mites are transmitted by direct contact between the dam and puppies shortly after birth.1,2,4 Canine demodicosis occurs when an altered immune response allows overproliferation of mites, leading to the development of clinical signs. This disease is most commonly caused by *D. canis*; however, other species, such as *Demodex injai* (a large-bodied mite) and *Demodex cornei* (a short-bodied mite), may also be involved.3 Although diagnosis of canine demodicosis can be straightforward, the disease can be challenging to manage because of the length of treatment, the need to identify and treat underlying causes, demands on the client (time and financial commitments), and the need for frequent follow-up visits to the veterinary clinic.

**Disease Classification**

Demodicosis can be classified as localized or generalized, with a juvenile or adult onset. Prognosis and treatment options vary, depending on the form of the disease. Criteria differentiating each form have not been uniformly established.2

**Localized Form**

The localized form usually involves six or fewer focal areas of the body (FIGURE 1), often including the face and forelegs.1,2 This form most often affects dogs younger than 1 year.4 Approximately 90% of cases spontaneously resolve,1,4 usually within 6 to 8 weeks,1,2 especially with juvenile onset.

**Generalized Form**

Generalized demodicosis is a more serious disease.1 The generalized form is suspected if more than six areas of the body are affected, two or more feet are affected, or an entire region of the body is involved.2 Approximately 30% to 50% of juvenile-onset cases of generalized demodicosis spontaneously resolve.1

**Key Points**

- Although canine generalized demodicosis can be diagnosed with proper skin-scrapping techniques, it can be challenging to treat.
- Adult-onset demodicosis should be investigated for underlying causes.
- Client education and compliance are critical to a successful outcome.

**Juvenile-Onset Form**

The juvenile-onset form typically presents before the dog reaches 1 year of age.1 Young patients may present with localized or generalized disease. Patients with localized demodicosis may not need to be treated. If treatment is recommended, topical therapy (e.g., benzoyl peroxide gel q24h) can be administered to affected areas.1 Some dogs with generalized demodicosis may initially present with localized lesions; however, with time, their clinical signs become representative of the generalized form. To identify patients with disease that will progress to the generalized form, it is important not to use systemic miticidal therapy to treat patients with localized disease.2–4 In most cases, young dogs with generalized demodicosis should be treated systemically because the disease can progress in a short period of time. It is thought that the juvenile-onset generalized form develops as a result of an inherited immune dysfunction; therefore, owners of patients with this form of disease should be advised that their dogs should not be bred.2,4

**Adult-Onset Form**

Adult-onset demodicosis is usually seen in adult dogs aged 4 years or older.1 It is important to inform the client that an underlying cause often exists and to look for concurrent diseases before treating the patient for demodicosis. If an underlying cause cannot be determined at diagnosis, monitoring should continue throughout treatment. The inability to identify and manage the underlying cause may decrease the likelihood of a successful outcome.1
Underlying causes include diabetes mellitus, hyperadrenocorticism (either naturally occurring or iatrogenic due to glucocorticoid administration), neoplasia, treatment with immunosuppressive agents, hypothyroidism, heartworm disease, intestinal parasitism, and leishmaniasis. To identify an underlying cause, a thorough history should be obtained and a complete physical examination performed. A minimum database (i.e., complete blood count, serum chemistry profile, heartworm test, fecal analysis, urinalysis) should be obtained. Additional tests for hyperadrenocorticism and thyroid function as well as radiography and ultrasonography may also be warranted, depending on the case.

Clinical Features
Many patients present with circular areas of alopecia. Occasionally, patients present with a diffuse area of thin haircoat. Pruritus is usually absent unless a concurrent allergy or secondary skin infection develops. If untreated, these patients may also develop hyperpigmentation and lichenification along with increased body odor due to excess sebum production from sebaceous glands associated with hair follicles. Draining tracts may also form due to rupturing hair follicles. The severity of clinical signs (e.g., fever, lymphadenopathy) can vary depending on the extent of the disease and the presence and type of concurrent illness.

Diagnosis
Demodicosis is seen most often in purebred dogs and puppies and young dogs up to 18 months of age. Demodicosis is diagnosed by performing skin scrapings. To find mites, it is necessary to obtain multiple, deep skin scrapings from affected areas. Proper sample collection techniques are essential when scraping for Demodex mites. A spatula or #10 scalpel blade can be used to collect the samples. Mineral oil should be applied either to the spatula/blade or directly to the area being scraped to ensure that the material being scraped sticks to the scraping instrument. Scraping should be deep enough to produce capillary bleeding while squeezing the area being scraped; this forces mites deep in the hair follicle to the surface. Microscopically, fusiform eggs, six-legged larvae, eight-legged nymphs, or eight-legged adult mites (dead or alive) can be seen. Ideally, for each scraping site, the number of mites (or at least an estimated percentage, including dead and living...
mites) in each life stage should be recorded in the patient’s medical record (BOX 1). These results can be used to monitor the response to treatment at future rechecks.

Trichography may be used to search for adult mites attached to the hair shaft. This procedure involves plucking some hairs in the direction of hair growth and placing them in mineral oil on a glass slide for microscopic examination. Because trichography is not as reliable as skin scraping for diagnosing demodicosis, it should complement and not replace skin scraping. Trichography may be helpful for yielding mites when collecting samples from areas of the skin that are difficult to squeeze or scrape, such as interdigital and periocular areas. Negative results from trichography do not rule out a diagnosis of demodicosis.

A punch biopsy may be needed if skin-scraping results are negative and the index of suspicion for demodicosis is high. The biopsy may be necessary in patients with thick skin (e.g., shar-pees) or chronic pododermatitis (FIGURE 4) when lesions are fibrotic.

**Treatment**

The general health of patients diagnosed with generalized demodicosis should be evaluated and managed before miticidal therapy is instituted. Treatment typically involves specific miticidal therapy for demodicosis along with adjunctive therapy, when needed. Treatment options depend on many factors, such as patient history, extent and location of clinical signs, and the patient’s breed. Before therapy for demodicosis is initiated, the veterinarian should ask the owner to list any medications or supplements that the dog is receiving. The client’s ability and willingness to administer a therapy should be discussed when choosing a therapy, as should financial considerations. Client compliance is extremely important to the success of treatment. Patients with demodicosis should not be treated with glucocorticoid therapy or other types of immunosuppressive drugs.

**Miticidal Therapy**

**Amitraz** (Mitaban, Pfizer Animal Health) is currently the only treatment approved by the Food and Drug Administration (FDA) for canine generalized demodicosis. Bathing with a benzoyl peroxide shampoo before dipping may be beneficial for its keratolytic effect and follicular flushing activity. Clipping medium- and long-haired dogs may facilitate dipping by allowing better contact between the skin and the dip solution. Mitaban dips are applied topically and licensed for use every 14 days. Product safety for pregnant animals or for dogs younger than 4 months has not been established. The solution should be prepared as labeled (dilute 1 bottle [10.6 mL] of Mitaban with 2 gal of warm water) immediately before application. The person applying the dip should wear gloves and protective clothing, and the patient should be treated in a well-ventilated area. Dip should not be towelied off; the patient should be allowed to dry naturally. Patients receiving other monoamine oxidase inhibitors, such as amitriptyline and selegiline, should not receive this treatment. After the first treatment, patients may experience lethargy and sedation for 24 to 48 hours. This is less likely to occur with subsequent treatments. Other adverse effects include bradycardia, hypothermia, and hyperglycemia. Patients with diabetes mellitus or facial involvement may not be good candidates for this therapy.

**Metaflumizone plus amitraz spot-on** (Promeris for Dogs, Fort Dodge Animal Health) is labeled to kill and control *Demodex* spp mites on dogs. In a recent study, the drug was administered to dogs either every 2 weeks or monthly with a minimum dose of 20 mg/kg (i.e., 0.133 mL/kg). Negative skin scrapings were obtained in 62.5% and 42.9% of the dogs receiving biweekly or monthly treatment, respectively. These dogs were not followed up after discontinuation of therapy.
Treatment using the products discussed below is considered off-label. Adverse effects of avermectins and milbemycins are rare and include mydriasis, hypersalivation, lethargy, ataxia, seizure, coma, and death.2,3,8 A heartworm-negative status should be confirmed before beginning the following therapies, and regular heartworm preventive medication can be discontinued throughout treatment with these products.4

Ivermectin (Ivomec injection for cattle and swine, Merial) is a common first-choice treatment of many dermatologists2,3,5 because it is easy to administer and reasonably priced. An injectable form of ivermectin is administered orally. The recommended dosage is 300 to 600 µg/kg PO q24h.2–4 Starting with a low dose (e.g., 50 µg/kg or 25% of the target dose2,3) and gradually increasing to the target dose is often recommended to identify adverse effects in sensitive patients.4 Clients should be advised that the solution has a bitter taste. Because of potential adverse effects on the central nervous system, this therapy should not be used in ivermectin-sensitive breeds (i.e., collie, Shetland sheepdog, Australian shepherd, Old English sheepdog, other herding breeds)8 unless an MDR1 (ABCB1) gene test9 (www.vetmed.wsu.edu/depts-vcpl) has been performed to determine the patient’s susceptibility to the toxic effects of ivermectin.

Doramectin (Dectomax, Pfizer Animal Health) is a long-acting avermectin that has been used at a dosage of 600 µg/kg SC once weekly.2,3 This drug should not be used in ivermectin-sensitive breeds (i.e., collie, Shetland sheepdog, Australian shepherd, Old English sheepdog, other herding breeds)9 unless an MDR1 (ABCB1) gene test9 (www.vetmed.wsu.edu/depts-vcpl) has been performed to determine the patient’s susceptibility to the toxic effects of ivermectin.

Imidacloprid 10% plus moxidectin 2.5% spot-on (Advantage Multi, Bayer Health Care, Animal Health Division) was administered to dogs two to four times, at 4-week intervals, at a dose of at least 0.1 mL/kg.12 In this study, parasitologic cure was achieved in 27 of 30 dogs after two to four monthly treatments. However, these dogs were not followed up after remission.

Adjunctive Therapy

It is important to treat secondary ear and skin infections (FIGURE 5) because they often cause pruritus and resolving them can make the patient more comfortable. If the patient has secondary pyoderma, oral antibiotics may be needed until complete resolution of lesions, which is assessed at the first 4-week recheck appointment. Patients with deep pyoderma require longer treatment until complete resolution. Antibacterial shampoos such as benzoyl peroxide and chlorhexidine can be beneficial for treating patients with secondary pyoderma. Shampooing can be done weekly or more often, as necessary. If an antibacterial shampoo is used with an amitraz dip, the patient should not be shampooed between dip treatments.

Reducing stress and providing adequate nutrition can also improve success in managing demodicosis. Feeding the dog a complete and balanced diet is important. Fatty-acid supplementation may also have a possible benefit.5 Underlying conditions such as endoparasite infections and concurrent diseases should be treated.

Monitoring Response to Treatment

After treatment begins, patients should be checked every 4 to 6 weeks until two consecutive negative skin-scraping results are obtained. At each visit, a physical examination should be performed and skin scrapings taken from the areas that were scraped initially and from any new lesions. The results should be recorded and compared with those from the previous visit. By the first recheck examination, very few, if any, Demodex mites in immature stages should be seen. Ideally, the percentage of dead adult mites should
be higher than the percentage of live adult mites. This indicates that the owner is being compliant and the therapy is working. Treatment should be continued for 4 weeks after the second negative skin-scraping result. It is not uncommon for treatment to take 6 to 12 months before two consecutive negative skin-scraping results are obtained. Once treatment is stopped, the patient is considered to be in remission. Rechecks and skin scrapings should be performed every 3 to 4 months for the next year. Relapses can occur within this time frame, so owners need to observe their dogs carefully for evidence of disease. One year after a second negative skin-scraping result and no recurrence of disease, the patient can finally be declared cured.1–3,10

**Prognosis**

The reported successful cure rate for juvenile-onset generalized demodicosis is 70% to 80%. Dogs with adult-onset generalized demodicosis have a significantly lower success rate, primarily when the underlying disease cannot be cured or well controlled. Early diagnosis and therapy may shorten the length of treatment. Treatment can fail, and some patients may need some type of therapy for the rest of their lives. Pododemodicosis is especially difficult to cure and carries a poor prognosis. Additional factors such as estrus, parturition, stress, and poor nutrition can also play a role in treatment failure.2,3

**Client Education**

Clients need to be well informed of the challenges, time, and expense involved in treating canine demodicosis. It is important that they also have a good understanding of the disease. Patients often appear clinically normal after 1 to 2 months of therapy, but it is vital that owners do not stop the treatment because mites may still be present and a relapse is likely without the full treatment. Clients also need to understand that if their dog has been diagnosed with adult-onset demodicosis but an underlying condition has not been found, an underlying disease could still be predisposing the dog to demodicosis. Owners of intact dogs with generalized demodicosis should be advised to spay or neuter their dogs (1) because of the hereditary predisposition to develop the disease and (2) to eliminate the stress of estrus, which can exacerbate the disease.

**Conclusion**

Treatment of canine demodicosis can be challenging, and therapeutic options depend on many factors, including type of demodicosis (localized or generalized, juvenile or adult onset), patient history and breed, underlying causes, and client considerations. Although obtaining a parasitologic cure using currently available treatments may take a long time, treating secondary infections or underlying conditions can greatly improve the patient’s comfort and prognosis.

**Acknowledgment**

The author thanks Sheila Torres, DVM, MS, PhD, DACVD, and Sandra Koch, DVM, MS, DACVD, of the University of Minnesota College of Veterinary Medicine for their time and support in reviewing this article.

**References**

1. Puppies usually acquire D. canis
   a. in utero.
   b. from direct contact with their dam shortly after birth.
   c. from indirect contact with an infected dog.
   d. from contaminated fomites.

2. Which form of canine demodicosis should not be treated with miticidal therapy?
   a. juvenile-onset, generalized demodicosis
   b. juvenile-onset, localized demodicosis
   c. adult-onset, generalized demodicosis
   d. none of the above

3. A 6-year-old dog is diagnosed with canine demodicosis, and all of its feet are affected. Which form of the disease does this dog have?
   a. juvenile-onset, generalized demodicosis
   b. juvenile-onset, localized demodicosis
   c. adult-onset, generalized demodicosis
   d. adult-onset, localized demodicosis

4. Which underlying condition could be associated with adult-onset, generalized demodicosis?
   a. hyperadrenocorticism
   b. hypothyroidism
   c. neoplasia
   d. all of the above

5. Which clinical feature(s) can be seen with canine demodicosis?
   a. alopecia
   b. hyperpigmentation
   c. thin haircoat
   d. all of the above

6. The most reliable method of diagnosing canine demodicosis is
   a. superficial skin scraping.
   b. deep skin scraping.
   c. trichography.
   d. clinical signs.

7. The only FDA-approved treatment for canine demodicosis is
   a. amitraz.
   b. ivermectin.
   c. milbemycin.
   d. doramectin.

8. Patients should be treated with miticidal therapy until
   a. clinical signs resolve.
   b. the first negative skin-scraping result.
   c. 1 month after the second negative skin-scraping result.
   d. 1 year after the second negative skin-scraping result.

9. Patients are considered cured of generalized demodicosis
   a. after clinical signs resolve.
   b. after the first negative skin-scraping result.
   c. 1 month after the second negative skin-scraping result.
   d. 1 year after the second negative skin-scraping result.

10. Which demodicosis case carries the poorest prognosis?
    a. a patient with two areas of alopecia
    b. a patient with pododemodicosis
    c. a patient with facial involvement
    d. a patient with pruritus